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COMMENTS OF ORMET CORPORATION

ON THE PROPOSED REMEDIAL ACTION PLAN

FOR THE ORMET CORPORATION SUPERFUND SITE

JUNE 9, 1994

APPENDICES VOLUME III

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FEDERAL ENVIRONMENTAL SUPERFUND RECORDS
Records of Decision - ROD

ROD DATE : August 19, 1991

SITE NAME : **BUCKEYE RECLAMATION**

LOCATION : ST. CLAIRSVILLE, OH 43950

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

BUCKEYE RECLAMATION LANDFILL SITE, BELMONT COUNTY, OHIO

STATEMENT OF BASIS AND PURPOSE

THIS DECISION DOCUMENT PRESENTS THE SELECTED REMEDIAL ACTION FOR THE **BUCKEYE RECLAMATION** LANDFILL SITE, IN BELMONT COUNTY, OHIO, WHICH WAS CHOSEN IN ACCORDANCE WITH THE REQUIREMENTS OF THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (CERCLA), AS AMENDED BY THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA) AND, TO THE EXTENT PRACTICABLE, THE NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN (NCP). THIS DECISION DOCUMENT EXPLAINS THE FACTUAL AND LEGAL BASIS FOR SELECTING THE REMEDY FOR THIS SITE.

THE OHIO ENVIRONMENTAL PROTECTION AGENCY CONCURS WITH THE SELECTED REMEDY. THE INFORMATION SUPPORTING THIS REMEDIAL ACTION DECISION IS CONTAINED IN THE ADMINISTRATIVE RECORD FOR THIS SITE.

ASSESSMENT OF THE SITE

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THIS SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION SELECTED IN THIS RECORD OF DECISION (ROD), MAY PRESENT AN IMMINENT AND SUBSTANTIAL THREAT TO PUBLIC HEALTH, WELFARE, OR THE ENVIRONMENT.

DESCRIPTION OF THE SELECTED REMEDY

THIS IS THE FIRST AND ONLY OPERABLE UNIT FOR THE SITE. THE REMEDY SELECTED IN THIS RECORD OF DECISION WILL ADDRESS PRINCIPAL THREATS POSED BY THE SITE BY TREATING CONTAMINATED SURFACE AND GROUND WATERS AND ELIMINATING EXPOSURE TO CONTAMINATED SURFACE

SOILS. BECAUSE THE SELECTED REMEDY INVOLVES LONG-TERM TREATMENT OF COLLECTED SURFACE LEACHATE AND GROUND WATER, OPERATION AND MAINTENANCE OF THE TREATMENT SYSTEM WILL BE REQUIRED.

MAJOR COMPONENTS OF THE SELECTED REMEDY INCLUDE THE FOLLOWING:

* SOLID WASTE LANDFILL CAP
* INSTITUTIONAL CONTROLS
* FENCING
* GROUND WATER COLLECTION
* SURFACE LEACHATE SEEP COLLECTION
* GROUND WATER MONITORING
* SURFACE LEACHATE SEEP MONITORING
* MONITORING OF KINGS RUN

* LEACHATE/GROUND WATER TREATMENT BY CONSTRUCTED WETLANDS

A SOLID WASTE LANDFILL CAP WILL BE CONSTRUCTED OVER ALL REAS WHERE LANDFILLING ACTIVITIES OCCURRED AND AREAS WHICH WOULD ALLOW WATER INFILTRATION INTO AND UNDER THE LANDFILL. THE GROUND WATER AND SURFACE LEACHATE COLLECTION SYSTEM WILL ELIMINATE CONTAMINATED WATER DISCHARGES INTO SURFACE WATERS AND CHANNEL THE COLLECTED WATERS TO A CONSTRUCTED WETLANDS. WETLANDS TREATMENT OF THE LANDFILL LEACHATE AND GROUND WATER IS AN INNOVATIVE TECHNOLOGY WHICH HAS PROVEN EFFECTIVE IN REMOVING CONTAMINANTS OF CONCERN DURING PRELIMINARY TREATABILITY STUDIES. PERIODIC SAMPLING OF WATER MEDIA AT THE SITE WILL MONITOR ANY CONTAMINANT MIGRATION. INSTALLING A FENCE AROUND THE SITE WILL DISCOURAGE TRESPASSING AND INSTITUTIONAL CONTROLS WILL BE SOUGHT TO SPECIFY THAT THE CONSTRUCTED REMEDY IS NOT TAMPERED WITH IN THE FUTURE.

DECLARATION OF STATUTORY DETERMINATIONS

THE SELECTED REMEDY IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, IS COST-EFFECTIVE AND COMPLIES WITH FEDERAL AND TATE REQUIREMENTS THAT ARE LEGALLY APPLICABLE OR RELEVANT AND APPROPRIATE TO THE REMEDIAL ACTION. A WAIVER CAN BE JUSTIFIED FOR ANY FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS THAT WILL NOT BE MET. THIS REMEDY UTILIZES PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT (OR RESOURCE RECOVERY) TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE, AND IT SATISFIES THE STATUTORY PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT THAT REDUCE TOXICITY, MOBILITY, OR VOLUME AS THEIR PRINCIPAL ELEMENT.

BECAUSE THIS REMEDY WILL RESULT IN HAZARDOUS SUBSTANCES REMAINING ON SITE ABOVE HEALTH-BASED LEVELS, A REVIEW WILL BE CONDUCTED EVERY FIVE YEARS AFTER COMMENCEMENT OF REMEDIAL ACTION TO ENSURE

THAT THE REMEDY CONTINUES TO PROVIDE ADEQUATE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT.

((SIGNATURE)) 8/19/91
U.S. EPA REGIONAL ADMINISTRATOR DATE
REGION V

DECISION SUMMARY FOR THE RECORD OF DECISION

I. SITE NAME, LOCATION, AND DESCRIPTION

THE **BUCKEYE RECLAMATION** LANDFILL (BRL) IS LOCATED OFF OF STATE ROUTE 214, APPROXIMATELY 4 MILES SOUTHEAST OF ST. CLAIRSVILLE AND 1.2 MILES SOUTH OF INTERSTATE 70 IN SECTIONS 20 AND 21 (TOWNSHIP 6 NORTH, RANGE 3 WEST), RICHLAND TOWNSHIP, BELMONT COUNTY OHIO (FIGURE 1). INTERSTATE 470 IS LOCATED JUST SOUTH OF THE LANDFILL ENTRANCE AND APPROXIMATELY 3,000 FEET NORTH OF THE LANDFILL AREA.

((MAP HERE))

THE BRL SITE IS SITUATED IN THE KINGS RUN DRAINAGE RAVINE; IT IS BORDERED BY KING'S RUN TO THE EAST AND UNNAMED RUN TO THE WEST. KING'S RUN FLOWS TO THE SOUTH AND EMPTIES INTO LITTLE MCMAHON CREEK. THE LANDFILL EXTENDS APPROXIMATELY 3,700 FEET NORTH TO SOUTH AND IS APPROXIMATELY 500 TO 1,000 FEET WIDE. THE SITE ON WHICH THE LANDFILL IS LOCATED OCCUPIES 658 ACRES. THE LANDFILL OCCUPIES APPROXIMATELY 50 ACRES OF THIS AREA.

THE ORIGINAL TOPOGRAPHY OF THE VALLEY OF KING'S RUN AND THE RIDGE TO THE WEST HAS BEEN ALTERED BY COAL MINE REFUSE DISPOSAL AND LANDFILL OPERATIONS (FIGURE 2). PRIOR TO 1950, COAL MINE REFUSE WAS REMOVED FROM DEEP COAL MINES AND DEPOSITED IN THE VALLEY. REFUSE PLACEMENT DAMMED KINGS RUN, CREATING NORTHERN, MIDDLE, AND SOUTHERN IMPOUNDMENTS. SUBSEQUENT LANDFILLING OPERATIONS RESULTED IN THE DRAINING AND FILLING OF THE MIDDLE AND SOUTHERN IMPOUNDMENTS BY 1972 AND 1976, RESPECTIVELY. A FOURTH IMPOUNDMENT, REFERRED TO AS THE WASTE PIT, WAS CREATED BY THE DAMMING OF A WESTERN TRIBUTARY OF KING'S RUN BY MINE REFUSE.

PROPERTY SURROUNDING THE SITE TO THE EAST AND WEST IS HILLY AND MOSTLY FORESTED. WEST OF THE SITE IS EBBERT ROAD. ALONG THIS ROAD ARE FARMS AND FURTHER TO WEST, A STRIP MINE. TO THE SOUTH, THE LAND IS FORESTED ALONG THE STEEPER SLOPES, AND CLEARED FOR RESIDENTIAL USE ALONG THE STREAM VALLEYS AND ROADWAYS. THERE IS MORE FARMLAND TO THE NORTH AND NORTHEAST.

WITHIN THE VICINITY OF THE SITE, THE MOST COMPLETE ACCOUNTING OF THE NUMBER OF HOUSEHOLDS WAS PERFORMED DURING THE DOMESTIC WELL SURVEY. APPROXIMATELY 200 HOMES WERE SURVEYED WITHIN A TWOMILE RADIUS OF THE SITE, DOWNSTREAM OF THE SITE BOUNDARIES.

APPROXIMATELY 40 HOUSEHOLDS ARE LOCATED WITHIN A 1-MILE RADIUS OF THE WASTE PIT. ASSUMING EQUIVALENCE WITH THE STATISTICS FOR THE REMAINDER OF RICHLAND TOWNSHIP, THIS EQUATES WITH A POPULATION OF 2.77 PERSONS PER HOUSEHOLD, OR 110.8 PEOPLE. THIS IS ALSO APPROXIMATELY EQUIVALENT TO 7 PERSONS OF UNDER 5 YEARS OLD, 18 FROM AGES 5-14, 36 FROM AGES 15-34, 38 FROM AGES 55-64, AND 13 FROM AGES 65 AND OVER. NATURAL RESOURCES IN BELMONT COUNTY, OHIO INCLUDE LARGE AREAS OF PREDOMINANTLY DECIDUOUS FOREST LAND (42 PERCENT), AGRICULTURAL LANDS (35 PERCENT), AND LANDS USED FOR COAL MINING (BOTH UNDERGROUND AND STRIP MINES). THERE ARE ALSO FOUR ACTIVE LIMESTONE QUARRIES IN THE COUNTY. AQUATIC BIOTA ARE CONSIDERED TO RECEIVE THE GREATEST IMPACT FROM THE SITE VIA SITE RUNOFF AND ACID MINE DRAINAGE (AMD) CONTRIBUTIONS TO LOCAL STREAMS.

SURFACE WATER USE IN THE AREA INCLUDES THE FOLLOWING UPSTREAM DISCHARGE POINTS FOR TREATED WASTEWATER TO LITTLE MCMAHON CREEK; 1) CITY OF ST. CLAIRSVILLE PUBLIC WATER SUPPLY, 2) CITY OF ST. CLAIRSVILLE WEST SEWAGE TREATMENT PLANT, AND 3) TREATED WASTEWATER FROM THE SAGINAW MINING CO. - SIGNAW PLANT. LITTLE MCMAHON CREEK IS ALSO DESIGNATED AS A LIMITED RESOURCE WATER (AMD-IMPACTED) STREAM.

((MAP HERE))

A TOTAL OF 46 DOMESTIC WELLS AND SPRINGS WERE IDENTIFIED AND LOCATED IN THE AREA DOWNGRADIENT OF AND WITHIN ONE MILE OF THE SITE, AND DOWNSTREAM FROM THE CONFLUENCE OF LITTLE MCMAHON CREEK AND KING'S RUN FOR AT LEAST TWO MILES.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

DEEP MINING OCCURRED BENEATH THE 658-ACRE SITE UNTIL AROUND 1940. DURING THAT TIME, THE SITE WAS A DISPOSAL AREA FOR MINE REFUSE. MINE REFUSE WAS REMOVED FROM THE MINES AND DISPOSED OF ON THE RIDGE WEST OF KING'S RUN (SEE FIGURE 2) AND IN THE DRAINAGE RAVINE FOR KING'S RUN. THE AREA WAS LICENSED AS A PUBLIC SOLID WASTE LANDFILL IN 1971 BY THE BELMONT COUNTY HEALTH DEPARTMENT AND HAS BEEN OPERATED BY OHIO RESOURCES CORPORATION, UNDER THE NAME OF **BUCKEYE RECLAMATION** COMPANY, SINCE THAT TIME. AS A PUBLIC LANDFILL APPROXIMATELY 50 ACRES IN SIZE, THE FACILITY ACCEPTED GENERAL TRASH, RUBBISH AND NONHAZARDOUS WASTE FROM MUNICIPALITIES AND VILLAGES IN THE COUNTY AND LOCAL AREA.

DETAILED RECORDS OF THE ACTUAL TYPES AND QUANTITIES OF WASTES AND THEIR ON-SITE LOCATION ARE LIMITED. A 1979 OEPA SOLID WASTE DISPOSAL QUESTIONNAIRE INDICATED THE FOLLOWING DISTRIBUTION OF MATERIALS RECEIVED BY THE SITE.

* 55% HOUSEHOLD
* 20% INDUSTRIAL

* 10% COMMERCIAL
* 5% AGRICULTURAL
* 5% CONSTRUCTION/DEMOLITION
* 2% INCINERATION RESIDUE
* 1% DEAD ANIMALS

IN ADDITION, THESE RECORDS INDICATE A TOTAL VOLUME OF APPROXIMATELY 950 TONS PER WEEK OR 49,400 TONS OF SOLID WASTE PER YEAR WERE DISPOSED AT THE SITE. THE LANDFILL ALSO ACCEPTED INDUSTRIAL SLUDGES AND LIQUIDS. MOST OF THESE WASTES WERE RECEIVED BETWEEN 1976 AND 1979 AND DEPOSITED IN OR NEAR THE WASTE PIT. THE WASTE PIT WAS AN IMPOUNDMENT LOCATED IN THE NORTHERN SECTION OF THE LANDFILL AREA (FIGURE 3). ESTIMATED TOTAL VOLUMES OF INDUSTRIAL WASTES RECEIVED ARE 4.7 MILLION GALLONS OF LIQUID AND 3,300 TONS OF INDUSTRIAL SOLID WASTES. TRANSPORTER RECORDS SHOW THAT THE MAJORITY OF THE LIQUIDS WERE OIL/SOLVENT/WATER MIXTURES. MALEIC ANHYDRIDE WASH WATER SLUDGE, NEUTRALIZED PICKLE LIQUOR SLUDGE, SODIUM SULFIDE, DESULFURIZATION PLANT SLUDGE, MALEIC ACID-FUMARIC ACID WASTES AND SPECIAL PUMPINGS FROM MALEIC OR FUMARIC ACID SPILLS WERE ALSO KNOWN TO HAVE BEEN DEPOSITED IN THE GENERAL AREA OF THE WASTE PIT.

((MAP HERE))

IN 1980, THE WASTE PIT WAS FILLED BY PUSHING SOME OF THE SLUDGE, MINE SPOIL AND OVERBURDEN SOIL INTO THE IMPOUNDMENT. PHOTOGRAPHIC EVIDENCE EXISTS THAT SOME OF THE SLUDGE WAS BURIED IN PLACE ON THE SLOPE OF THE WASTE PIT. THE WASTE PIT AREA WAS THEN COVERED WITH SOIL AND GARBAGE AND SEEDED TO GRASSES. A LOW SOIL BERM WAS GRADED IN PLACE UPGRADIENT OF THE WASTE PIT TO ROUTE SURFACE FLOW AROUND THE AREA AND PREVENT EROSION.

SOLID INDUSTRIAL WASTES (I.E. ASBESTOS, CARBON BLACK, FLY ASH, ETC.) WERE DISPOSED OF WITH MUNICIPAL WASTES ELSEWHERE IN THE LANDFILL. OHIO ENVIRONMENTAL PROTECTION AGENCY (OEPA) LANDFILL INSPECTION REPORTS ALSO SPEAK OF UNSPECIFIED INDUSTRIAL WASTE BEING DISPOSED OF IN THE SOUTHEASTERN PORTION OF THE LANDFILL.

THE **BUCKEYE RECLAMATION** LANDFILL SITE WAS LISTED ON THE NATIONAL PRIORITIES LIST BY PUBLICATION IN THE FEDERAL REGISTER ON SEPTEMBER 8, 1983. A POTENTIALLY RESPONSIBLE PARTY (PRP) SEARCH IDENTIFIED A NUMBER OF PARTIES, INCLUDING THE LANDFILL OPERATOR AND SEVERAL GENERATORS. NEGOTIATIONS WITH PRPS FOR CONDUCTING THE RI/FS WERE SUCCESSFULLY CONCLUDED ON SEPTEMBER 19,1985. AN ADMINISTRATIVE ORDER BY CONSENT (AOC) FOR THIS SITE WAS SIGNED OCTOBER 31, 1985. SIGNATORY TO THE AOC ARE CRAVAT COAL COMPANY, THE LANDFILL OPERATOR, AND ASHLAND CHEMICAL COMPANY, ARISTECH CHEMICAL COMPANY (FORMERLY U.S. STEEL CORPORATION), BEAZER EAST,INC. (FORMERLY KOPPERS COMPANY, INC.), TRIANGLE PWC AND SKF INDUSTRIES, AS WASTE GENERATORS. ON JUNE 26, 1986 THE CONSENT

ORDER WAS MODIFIED TO INCLUDE KITTLE HAULING, A TRANSPORTER, AS A RESPONDENT TO THE AOC.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

THE FEASIBILITY STUDY AND THE PROPOSED PLAN FOR THE **BUCKEYE RECLAMATION** LANDFILL SITE WERE RELEASED TO THE PUBLIC FOR COMMENT ON MAY 15, 1991. THESE TWO DOCUMENTS WERE MADE AVAILABLE TO THE PUBLIC IN THE ADMINISTRATIVE RECORD AND INFORMATION REPOSITORIES MAINTAINED AT THE EPA DOCKET ROOM IN REGION FIVE, AT THE ST. CLAIRSVILLE PUBLIC LIBRARY, ST. CLAIRSVILLE, OHIO, AND THE NEFFS BRANCH OF THE MARTINS FERRY PUBLIC LIBRARY, NEFFS, OHIO. THE NOTICE OF AVAILABILITY FOR THE DOCUMENTS WAS PUBLISHED IN THE TIMES LEADER, MARTINS FERRY, OHIO AND THE INTELLIGENCER, WHEELING, WEST VIRGINIA ON MONDAY, MAY 13, 1991. AS REQUIRED BY CERCLA SECTIONS 113 AND 117, A PUBLIC COMMENT PERIOD ON THE DOCUMENTS WAS HELD FROM MAY 15, 1991 TO JUNE 24, 1991. IN ADDITION, A PUBLIC MEETING WAS HELD ON MAY 30, 1991. AT THIS MEETING, REPRESENTATIVES FROM U.S. EPA AND OHIO EPA ANSWERED QUESTIONS ABOUT PROBLEMS AT THE SITE AND THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION. THE PROCEEDINGS WERE TRANSCRIBED BY A COURT REPORTER. A RESPONSE TO THE COMMENTS RECEIVED DURING THIS PERIOD IS INCLUDED IN THE RESPONSIVENESS SUMMARY, WHICH IS PART OF THIS ROD.

IV. SCOPE AND ROLE OF RESPONSE ACTION WITHIN SITE STRATEGY

AS WITH MANY SUPERFUND SITES, THE PROBLEMS AT THE **BUCKEYE RECLAMATION** LANDFILL SITE ARE COMPLEX. ADVERSE ENVIRONMENTAL IMPACTS ARE DERIVED FROM COAL MINE REFUSE PRESENT ON THE SITE (ACID MINE DRAINAGE), HAZARDOUS WASTE DISPOSAL PRACTICES AND SOLID WASTE DISPOSAL WHICH HAVE OCCURRED AT THE SITE. AS IS DISCUSSED BELOW, SURFACE AND SUBSURFACE SOILS AND SURFACE AND GROUND WATER ARE CONTAMINATED TO VARIOUS DEGREES. CURRENT AND POTENTIAL RISKS TO HUMAN HEALTH AND THE ENVIRONMENT ARE SHOWN TO BE POSED BY THIS CONTAMINATION. THIS ROD SELECTS A REMEDIAL ACTION FOR THE SITE WHICH ADDRESSES RISKS POSED BY ALL IDENTIFIED PATHWAYS.

V. SUMMARY OF SITE CHARACTERISTICS

THE **BUCKEYE RECLAMATION** LANDFILL REMEDIAL INVESTIGATION (RI) INVESTIGATED THE CONTAMINANT SOURCE AREA (LANDFILL), SOILS, SURFACE WATER AND SEDIMENTS, LEACHATE, GROUNDWATER, AND AIR. NUMEROUS CARCINOGENIC AND NONCARCINOGENIC CONTAMINANTS WERE DETECTED IN MOST MEDIA SAMPLED. TABLE 1 SUMMARIZES THE AVERAGE AND MAXIMUM CONCENTRATIONS OF ALL CHEMICALS IDENTIFIED IN MEDIA OF CONCERN AT THE SITE.

A. SOURCE AREA

AN ELECTROMAGNETIC (EM) SURVEY WAS FIRST PERFORMED TO ASCERTAIN THE PRESENCE OF BURIED DRUMS OR A DISTINGUISHABLE GROUND WATER PLUME OF CONTAMINATION. FINDINGS OF THIS SURVEY DID NOT REVEAL ANY BURIED DRUMS AND WERE UNABLE TO ESTABLISH THE PRESENCE OF A CONTAMINANT PLUME.

FIVE LOCATIONS WITHIN THE WASTE PIT WERE SELECTED FOR SOIL BORINGS TO DELINEATE CONTAMINANTS PRESENT. FOUR OF THE BORINGS WERE TAKEN FOR CHEMICAL ANALYSES AND THE FIFTH WAS COLLECTED FOR PHYSICAL TESTING OF THE SOIL CHARACTERISTICS. THE CHEMICAL ANALYSES IDENTIFIED HIGH LEVELS OF VOLATILE ORGANIC COMPOUNDS, SEMIVOLATILE ORGANIC COMPOUNDS AND METALS IN THE WASTE PIT SOILS. CONCENTRATIONS OF THE VOLATILE AND SEMIVOLATILE CONTAMINANTS PEAKED AT TWO DIFFERENT DEPTHS IN THE WASTE PIT AND THESE PEAKS WERE ASSOCIATED WITH A BROWN, ODOROUS OIL VISUALLY IDENTIFIED IN THE BORINGS. IT IS BELIEVED THAT THIS IS THE LIQUID ORIGINALLY PRESENT IN THE WASTE PIT BEFORE IT WAS FILLED.

B. SOILS

TWELVE BORINGS WERE PERFORMED THROUGHOUT THE SITE TO COLLECT LANDFILL SOILS FOR CHEMICAL ANALYSIS. NUMEROUS VOLATILE ORGANIC COMPOUNDS, SEMIVOLATILE ORGANIC COMPOUNDS AND METALS WERE DETECTED THROUGHOUT THE BORINGS. LOW LEVELS OF ASBESTOS AND PESTICIDES WERE ALSO DETECTED. IN GENERAL, THE CONCENTRATIONS OF CONTAMINANTS WERE LOWER THAN THOSE OF THE WASTE PIT.

C. SURFACE WATER

NINE SURFACE WATER STATIONS WERE CONSTRUCTED TO MONITOR SURFACE WATER QUALITY IN KING'S RUN, UNNAMED RUN AND LITTLE MCMAHON CREEK. TWO SURFACE WATER RUNOFF STATIONS WERE ALSO CONSTRUCTED TO EVALUATE WATER RUNNING OFF OF THE SURFACE OF THE WASTE PIT AND ASBESTOS DISPOSAL AREA WHICH IS LOCATED IN THE SOUTHERN PORTION OF THE LANDFILL. SAMPLE ANALYSES DETERMINED THAT SEVERAL SEMIVOLATILE ORGANIC COMPOUNDS AND HEAVY METALS WERE PRESENT IN THE SURFACE WATERS (SEE TABLE 1, P. 43).

D. SEDIMENTS

SEDIMENT SAMPLES WERE COLLECTED AT ELEVEN LOCATIONS WHICH INCLUDED EIGHT OF THE NINE SURFACE WATER STATIONS, ONE IN KING'S RUN SOUTH OF THE ASBESTOS DISPOSAL AREA AND TWO IN THE FORMER DRAINAGE DITCH WHICH RUNS ON THE WEST SIDE OF THE ACTIVE LANDFILL. SEVERAL SEMIVOLATILE ORGANIC COMPOUNDS AND A WIDE RANGE OF METALS WERE DETECTED (SEE TABLE 1, P. 43).

CONCENTRATIONS OF THE METALS VARIED GREATLY. A TRACE OF ASBESTOS WAS DETECTED IN ONE SAMPLE.

E. LEACHATE

SIX LEACHATE SAMPLES WERE COLLECTED TO PROVIDE ADDITIONAL INFORMATION ON THE WATER-BEARING FORMATIONS IN WHICH ON-SITE MONITORING WELLS WERE INSTALLED. THREE LEACHATE SEEPS WERE SAMPLED IN THE VICINITY OF THE WASTE PIT, ONE ALONG UNNAMED RUN, ONE ALONG KING'S RUN AND ONE AT THE SOUTHERN TOE OF THE LANDFILL. FIVE OF THE SIX LEACHATE SEEPS ARE AFFECTED TO SOME DEGREE BY MINE SPOILS AND AT LEAST TWO OF THE LEACHATE SEEPS ARE IMPACTED BY WASTE DISPOSAL PRACTICES. THE SAMPLING RESULTS SHOWED HIGH LEVELS FOR METALS INCLUDING ARSENIC, CADMIUM AND CHROMIUM (SEE TABLE 1, P. 42). IRON, MANGANESE, AND SULFATE WERE ALSO DETECTED BUT ARE NOT OF AS MUCH HEALTH CONCERN. COMPARISON OF THE VARIOUS SAMPLING LOCATIONS INDICATES THAT SOME OF THE INORGANIC CONTAMINATION COULD BE COMING FROM THE COAL MINE SPOILS LOCATED ON-SITE. THREE SEMIVOLATILE ORGANIC COMPOUNDS WERE DETECTED IN THE LEACHATE AND LOW LEVELS OF VOLATILE ORGANIC COMPOUNDS WERE IDENTIFIED.

F. AIR

THE AIR INVESTIGATION EXAMINED THE POTENTIAL FOR AIR RELEASES FROM THE WASTE PIT AND ASBESTOS DISPOSAL AREA. THIS INVESTIGATION INVOLVED TWO STUDIES: 1) A PERIMETER AIR SURVEY TO DETERMINE PERSONAL PROTECTION LEVELS FOR ON-SITE WORK, AND 2) A QUANTITATIVE AIR MONITORING STUDY TO QUANTIFY ON-SITE EXPOSURE. THE PERIMETER AIR SURVEY FOUND NO DETECTABLE ASBESTOS OR ORGANIC VAPORS, EXCEPT METHANE, PRESENT ANYWHERE ON THE SITE IN THE AIR.

G. GROUND WATER

A NETWORK OF 25 MONITORING WELLS WAS INSTALLED THROUGHOUT THE SITE. WATER BEARING UNITS SAMPLED INCLUDE THE UNCONSOLIDATED MATERIAL ABOVE THE FIRST CONFINING LAYER (SHALLOW UPPER ZONE OR A-ZONE), SEVERAL BEDROCK AQUIFERS INCLUDING THE WEGEE LIMESTONE, WAYNESBURG COAL, UNIONTOWN SANDSTONE, AND BENWOOD LIMESTONE (DEEP UPPER ZONES OR BZONE), AND AN AQUIFER WHICH UNDERLIES THE ENTIRE SITE, THE REDSTONE LIMESTONE (DEEP ZONE OR C-ZONE) (SEE FIGURE 4). THE HYDROGEOLOGY OF THE SHALLOW UPPER ZONE APPEARS TO BE CONTROLLED BY THE ORIGINAL TOPOGRAPHY AND GROUND WATER GENERALLY FLOWS NORTH TO SOUTH. WATER ENTERS THE SHALLOW UPPER ZONE THROUGH; 1) THE NORTHERN IMPOUNDMENT, 2) KING'S RUN, AND 3) INFILTRATION FROM THE NORTHWEST. GROUND WATER FLOW DIRECTIONS ARE TO THE NORTH AND SOUTHWEST IN THE WEGEE

LIMESTONE AND WAYNESBURG COAL, RESPECTIVELY. WATER LEVELS IN THE UNIONTOWN SANDSTONE INDICATE FLOW FROM THE EAST TO THE SOUTHWEST, WEST, AND NORTHWEST. WATER ENTERS THE BENWOOD LIMESTONE CHIEFLY IN ITS OUTCROP AREA, MUCH OF IT BY PERCOLATION THROUGH THE MINE SPOIL, AND MOVES GENERALLY SOUTHWARD IN RESPONSE TO THE REGIONAL GRADIENT. THE REDSTONE LIMESTONE ONLY PRODUCED GROUNDWATER AT TWO WELL LOCATIONS. ALL BEDROCK FORMATIONS SHOW NO INDICATIONS OF ANY SUBSTANTIAL PRIMARY POROSITY OR PERMEABILITY. GROUND WATER YIELDS ARE THE RESULT OF SECONDARY POROSITY AND PERMEABILITY AT JOINT FACES, COAL CLEATS, AND ALONG BEDDING PLANES. IN, GENERAL, MOST GROUND WATER EMANATING FROM BENEATH THE **BUCKEYE RECLAMATION** LANDFILL SITE IS DISCHARGED LATERALLY TO SURFACE WATER BEFORE LEAVING THE SITE.

THE OVERALL GROUND WATER QUALITY OF THE AREA REFLECTS HIGH LEVELS OF INORGANIC CONSTITUENTS (SEE TABLE 1, PAGES 38 - 42). MOST OF THE MONITORING WELLS ON-SITE, INCLUDING THE BACKGROUND WELLS, EXCEED SECONDARY MAXIMUM CONTAMINANT LEVELS (SMCLS) FOR TOTAL DISSOLVED SOLIDS (TDS), IRON, MANGANESE, AND SULFATES. MAXIMUM CONTAMINANT LEVELS (MCLS) FOR A NUMBER OF CONTAMINANTS, INCLUDING BENZENE, ARSENIC, CHROMIUM AND LEAD, WERE EXCEEDED IN SEVERAL WATER-BEARING ZONES. NINETEEN VOLATILE ORGANIC COMPOUNDS WERE DETECTED IN MONITORING WELLS. MOST WERE AT LOW CONCENTRATIONS OF LESS THAN 10 UG/1. A-ZONE WELLS CONTAINED THE LARGEST NUMBER OF VOCS (11), B-ZONE WELLS HAD FEWER (6), AND C-ZONE WELLS THE FEWEST (2). SEMIVOLATILE COMPOUNDS DETECTED IN WELLS INCLUDED NAPHTHALENE, 4-METHYL PHENOL, AND BENZOIC ACID AT LOW CONCENTRATIONS. A WIDE VARIETY OF TYPES AND CONCENTRATIONS OF METALS WERE DETECTED IN THE MONITORING WELLS. METALS FOUND MOST COMMONLY INCLUDE ALUMINUM, CALCIUM, IRON, MAGNESIUM, POTASSIUM, AND SODIUM. OTHER METALS FOUND AT LESSER CONCENTRATIONS INCLUDE BARIUM, CHROMIUM, COPPER, NICKEL, ZINC, ARSENIC, CADMIUM, LEAD OR MERCURY.

((MAP HERE))

DOWNGRADIENT RESIDENTIAL WELLS WERE ALSO TESTED TO DETERMINE IF THE SITE WAS IMPACTING DRINKING WATER SUPPLIES. METALS WERE PRIMARILY DETECTED IN THE WELLS. IN ADDITION, TWO ORGANICS, TOLUENE AND TRICHLOROFLUOROMETHANE, WERE IDENTIFIED. TRICHLOROFLUOROMETHANE WAS NOT DETECTED ON THE **BUCKEYE RECLAMATION** SITE. HOWEVER, TOLUENE WAS FOUND IN MANY SAMPLES ON THE SITE. THE OCCURRENCE OF TOLUENE MAY INDICATE THAT CONTAMINATION IS MIGRATING FROM THE SITE.

H. SUMMARY

THE PRIMARY OBJECTIVE OF THE RI WAS TO DEFINE THE NATURE AND EXTENT OF CONTAMINATION AT THE **BUCKEYE RECLAMATION** LANDFILL SITE. SAMPLING RESULTS IDENTIFIED VARIOUS LEVELS OF CONTAMINATION IN ALL MEDIAS SAMPLED, EXCEPT AIR. THREE SOURCES OF THE CONTAMINATION WERE OBSERVED; 1) INDUSTRIAL WASTES DISPOSED IN OR AROUND THE WASTE PIT, 2) SOLID WASTES DISPOSED IN THE GENERAL LANDFILL AREA AND, 3) COAL MINE REFUSE WHICH WERE PLACED IN THE AREA BEFORE LANDFILLING OPERATIONS BEGAN.

THE RI FOCUSED ON DETERMINING IF MIGRATION OF CONTAMINANTS FROM THE WASTE PIT AREA HAD OCCURRED BY ESTABLISHING CONTAMINANT LEVELS IN THE BACKGROUND, COAL MINE REFUSE, GENERAL LANDFILL AND THE WASTE PIT. HIGH LEVELS OF HEAVY METAL CONTAMINATION WERE FOUND IN BURIED SLUDGES NEAR THE WASTE PIT AS WELL AS IN THE COAL MINE SPOILS. OVERALL, THE STUDY DID ESTABLISH THAT HIGH LEVELS OF CONTAMINATION, DERIVED FROM INDUSTRIAL WASTE DISPOSAL ACTIVITIES EXIST IN THE WASTE PIT AREA. THERE IS EVIDENCE THAT CONTAMINANTS HAVE MOVED FROM THE WASTE PIT SEDIMENTS AT LEAST AS FAR AS MONITORING WELL 4A (REFER TO FIGURE 4), ABOUT 100 FEET EAST OF THE WASTE PIT. CONTAMINANTS EMANATING FROM THE WASTE PIT MAY HAVE MOVED BEYOND WELL 4A, TO THE VICINITY OF MONITORING WELL 7A, AND EVEN FARTHER, BUT THE EVIDENCE IS NOT CONCLUSIVE.

MIGRATION OF CONTAMINANTS FROM THE WASTE PIT IS A CONCERN BECAUSE THESE CONTAMINANTS FURTHER DEGRADE GROUNDWATER IN THE AREA. GROUNDWATER WHICH HAS MIGRATED THROUGH THE LANDFILL AND COAL MINE SPOIL CAN ALSO BE RELEASED TO SURFACE WATERS THROUGH LEACHATE OUTBREAKS, FURTHER DEGRADING SURFACE WATER QUALITY. SOILS WHICH HAVE COME IN CONTACT WITH THE HAZARDOUS WASTES DISPOSED AT THE SITE AND/OR LEACHATE EMANATING FROM THE SITE HAVE ALSO BECOME CONTAMINATED.

TRESPASSERS AND PEOPLE WHO WORKED IN THE ACTIVE PORTION OF THE LANDFILL MAY HAVE BEEN EXPOSED TO SITE RELATED CONTAMINATION. KING'S RUN AND LITTLE MCMAHON CREEK, WHICH RECEIVE DRAINAGE WATER FROM THE SITE, HAVE BEEN DESIGNATED AS LIMITED RESOURCE WATERS (AMD-IMPACTED) AND ARE VULNERABLE TO CONTAMINANT RELEASES FROM THE LANDFILL.

VI. SUMMARY OF SITE RISKS

AN ENDANGERMENT ASSESSMENT (EA), WHICH RECEIVED EXTENSIVE U.S. EPA AND OEPA INPUT, WAS CONDUCTED IN ORDER TO DETERMINE THE EXTENT OF THE THREAT TO PUBLIC HEALTH AND THE ENVIRONMENT UNDER PRESENT AND FUTURE CONDITIONS, AND TO DETERMINE WHICH ASPECTS OF THE SITE MERIT REMEDIATION (**BUCKEYE RECLAMATION** LANDFILL ENDANGERMENT ASSESSMENT, **BUCKEYE RECLAMATION** LANDFILL STEERING

COMMITTEE, 1991). THE EA ASSESSES HEALTH RISKS BY SELECTING INDICATOR CHEMICALS, EVALUATING PATHWAYS THROUGH WHICH THE CONTAMINANTS COULD COME IN CONTACT WITH PEOPLE, CALCULATING RISKS THEN POSED BY EACH CHEMICAL IN EACH PATHWAY AND SUMMING RELEVANT RISKS FOR CURRENT AND FUTURE USES OF THE SITE. THERE ARE TWO TYPES OF RISKS THAT CONTAMINATION FROM A SITE MAY POSE TO HUMANS, CARCINOGENIC AND NONCARCINOGENIC. ALL PEOPLE CARRY A RISK OF CONTRACTING CANCER IN THEIR LIFETIME. THE EA ESTIMATES THE EXCESS ENVIRONMENTAL RISKS, POSED BY THE SITE OVER AND ABOVE THE AVERAGE RISK. EXCESS UPPER BOUND LIFETIME CANCER RISKS RANGING BETWEEN 10((-4)) AND 10((-6)) (ONE PERSON IN TEN THOUSAND TO ONE PERSON IN ONE MILLION) ARE CONSIDERED ACCEPTABLE. HOWEVER, A RISK OF 10((-6)) WILL SERVE AS THE POINT OF DEPARTURE FOR REMEDIATION GOALS FOR THE BRL SITE. NONCARCINOGENIC RISKS ARE THOSE WHICH CAUSE OTHER ILLNESSES SUCH AS IMPAIRED ORGAN FUNCTION, DAMAGE TO THE NERVOUS SYSTEM, ETC. NONCARCINOGENIC HEALTH EFFECTS ARE MEASURED BY A 'HAZARD INDEX', WHICH IS A CALCULATION OF A RATIO OF EXPOSURE TO DOSE AT WHICH NO EFFECT IS SEEN. IF POTENTIAL EXPOSURES TO CONTAMINANTS RESULT IN HAZARD INDICES WHICH ARE GREATER THAN A VALUE OF ONE, THEN NONCANCER HEALTH EFFECTS MAY RESULT FROM EXPOSURE.

A. SELECTION OF CONTAMINANTS OF CONCERN

AS WAS INDICATED PREVIOUSLY, THERE ARE THREE POTENTIAL SOURCES OF CONTAMINATION AT THE **BUCKEYE RECLAMATION** LANDFILL SITE. IN THE BUCKEYE EA, THE HAZARDS/RISKS ATTRIBUTABLE TO THE FOLLOWING CONTAMINANTS WERE COMPARED TO HAZARDS/RISKS ASSOCIATED WITH PRE-LANDFILL CONDITIONS (CONDITIONS WHICH WOULD INCLUDE CONTAMINATION LEVELS RESULTING FROM COAL MINE REFUSE). TWELVE CONTAMINANTS DETECTED IN THE WASTE PIT, SOILS, LEACHATE, GROUND WATER, AND SURFACE WATER WERE IDENTIFIED AS INDICATOR CHEMICALS. INDICATOR CHEMICALS WERE CHOSEN BASED ON FACTORS SUCH AS THE NUMBER OF TIMES A CHEMICAL WAS DETECTED, THE MAXIMUM CONCENTRATION, AND PERSISTENCE AND TOXICITY TO HUMAN HEALTH AND THE ENVIRONMENT. THE INDICATOR CHEMICALS LISTED BELOW ACCOUNT FOR THE MAJORITY OF HEALTH-BASED RISK FROM CONDITIONS AT THE **BUCKEYE RECLAMATION** LANDFILL.

INORGANICS	ORGANICS
ARSENIC	BENZENE
BERYLLIUM	TRICHLOROETHENE
LEAD	CARBON TETRACHLORIDE
CADMIUM	1,1-DICHLOROETHENE
CHROMIUM	CARCINOGENIC PAHS
NICKEL	TOLUENE

B. ASSUMPTIONS AND CONSTANTS USED

THE TOXICITY FACTORS FOR QUANTIFICATION OF SUBCHRONIC, CHRONIC AND LIFETIME HAZARDS FOR INDICATOR CHEMICALS AT THE BUCKEYE SITE ARE GIVEN IN TABLE 2. ADJUSTED ORAL TOXICITY VALUES FOR QUANTIFICATION OF SUBCHRONIC, CHRONIC, AND LIFETIME DERMAL HAZARDS AND RISKS ASSOCIATED WITH INDICATOR CHEMICALS ARE GIVEN IN TABLE 3. A SUMMARY OF NONCANCER HAZARD/CANCER RISK CALCULATIONS FOR ENVIRONMENTAL MEDIA ARE PROVIDED IN TABLE 4.

C. BASELINE RISK ASSESSMENT

AS PART OF THE EA, A BASELINE RISK ASSESSMENT WAS CONDUCTED. THIS EVALUATION WAS PERFORMED TO DETERMINE THE LIKELIHOOD OF CURRENT OR FUTURE EXPOSURES GENERATING ADVERSE HEALTH AFFECTS, SUCH AS CANCER. TO ASCERTAIN THE LEVEL OF REMEDIATION WARRANTED AT THE SITE, THE RISK ASSESSMENT ALSO DETERMINED WHICH CONTAMINANTS AND EXPOSURE PATHWAYS NEED TO BE ADDRESSED IN THE REMEDIAL ACTION. TABLE 5 PROVIDES THE MAJOR FINDINGS OF THE EA FOR THE BRL SITE.

ROUTES OF EXPOSURE WERE IDENTIFIED THROUGH WHICH THE PUBLIC AND ENVIRONMENTAL RECEPTORS COULD COME IN CONTACT WITH CONTAMINATION AT THE SITE. BOTH CURRENT-USE PATHWAYS AND FUTURE-USE PATHWAYS WERE EXAMINED.

D. EVALUATION OF FUTURE RISKS

POTENTIAL FUTURE-USE EXPOSURE ROUTES MAY EVOLVE IF THE LAND UPON WHICH THE LANDFILL IS SITUATED IS USED FOR DIFFERENT PURPOSES. AS A MEANS OF ASSESSING A WORST CASE SITUATION, IF NO REMEDIATION OCCURS AT THE SITE, A FUTURE-USE SCENARIO WAS DEVELOPED IN WHICH RESIDENTIAL HOUSING WAS BUILT ON SITE, AND RESIDENTS, INCLUDING CHILDREN, WERE EXPOSED TO CONTAMINANTS. THE POTENTIAL ROUTES OF EXPOSURE EVALUATED UNDER THESE CONDITIONS WERE:

1. INGESTION OF ON-SITE SURFACE WATER, GROUNDWATER, OR OFF-SITE RESIDENTIAL WELL WATER,
2. INCIDENTAL INGESTION OF ON-SITE SOIL,
3. INHALATION OF VOCS WHILE SHOWERING,
4. DERMAL CONTACT WITH ON-SITE GROUND WATER OR OFFSITE RESIDENTIAL WELL WATER, AND
5. DERMAL CONTACT WITH ON-SITE SOIL.

UNDER THE FUTURE USE SCENARIO, BOTH EXCESS CANCER RISKS AND NONCARCINOGENIC HAZARDS WERE IDENTIFIED. FOR NONCARCINOGENIC EXPOSURES, GROUND WATER AND SURFACE WATER UTILIZATION ARE OF PRIMARY CONCERN. HAZARD INDICES FOR BOTH AVERAGE AND MAXIMUM CONTAMINANT CONCENTRATIONS AT THE BRL

SITE ARE GREATER THAN ONE, RANGING FROM VALUE OF 7.81 TO 21.3.

EXCESS CANCER RISK ESTIMATES WERE ALSO IDENTIFIED FOR EXPOSURES TO SITE SOIL, GROUND WATER, AND SURFACE WATER. SITE RELATED POTENTIAL CANCER RISKS RANGE FROM 6.53 X 10((-3)) TO 1.48 X 10((-2)) FOR AVERAGE AND MAXIMUM CHEMICAL CONCENTRATIONS, RESPECTIVELY.

E. EVALUATION OF CURRENT RISKS

CURRENT RISKS FROM SITE RELATED CONTAMINATION WERE EVALUATED. THESE RISKS WERE ASSOCIATED WITH CONTAMINANT EXPOSURE TO ADULTS AND ADOLESCENTS WHO GO ONTO THE SITE. UNDER CURRENT CONDITIONS AT THE SITE, THE EXISTING ROUTES OF EXPOSURE INCLUDE:

1. INCIDENTAL INGESTION OF ON-SITE SOIL,
2. INHALATION OF ON-SITE PARTICULATES,
3. DERMAL CONTACT WITH ON-SITE SOILS AND LEACHATE, AND
4. DERMAL CONTACT WITH ON-SITE SURFACE WATER.

NONE OF THE EXISTING EXPOSURE PATHWAYS FOR THE BRL SITE WERE ASSOCIATED WITH NONCARCINOGENIC HAZARDS INDICES GREATER THAN ONE. OF THE EXISTING EXPOSURE PATHWAYS IDENTIFIED FOR THE BRL SITE, ONLY THE INHALATION OF FUGITIVE DUSTS WAS ASSOCIATED WITH EXCESS CANCER RISKS. CURRENT USE CANCER RISKS RANGE FROM 3.76 X 10((-4)) TO 1.05 X 10((-3)) FOR AVERAGE AND MAXIMUM CHEMICAL CONCENTRATIONS, RESPECTIVELY.

F. ECOLOGICAL ASSESSMENT

AN ECOLOGICAL ASSESSMENT WAS PERFORMED AS PART OF THE EA. THE OBJECTIVE OF THE ECOLOGICAL ASSESSMENT WAS TO EXAMINE IMPACTS ON THE LOCAL ENVIRONMENT, POSED BY THE SITE. THE STUDY ALSO ATTEMPTED TO DIFFERENTIATE EFFECTS FROM ACID MINE DRAINAGE AND WASTE DISPOSAL PRACTICES ON THE ENVIRONMENT.

THE CONTAMINANT LEVELS IN THE SOIL AND SURFACE-WATER SAMPLES DOWNGRADIENT FROM THE SITE ARE ELEVATED AS INDICATED BY THE MONITORING RESULTS FROM THESE MEDIA. ACUTE TOXIC EFFECTS FROM THE CONTAMINANTS AT LEVELS (SEE TABLE 1) PRESENT (IN SOIL AND SURFACE WATER) MAY CAUSE DEATH TO ANIMALS, PLANTS, BIRDS AND FISH; THEY MAY ALSO CAUSE SUPPRESSED GROWTH RATES/CROP YIELDS IN PLANTS.

THE CONTAMINANTS PRESENT AT THE BRL SITE MAY POTENTIALLY ACCUMULATE IN THE TISSUES OF PLANTS, FISH, SHELLFISH, AND ANIMALS. CHRONIC TOXIC EFFECTS ON ANIMALS AND BIRDS INCLUDE

A SHORTENED LIFE SPAN, REPRODUCTIVE PROBLEMS, LOWER FERTILITY, CHANGES IN APPEARANCE AND BEHAVIOR AND/OR DEATH. THE EFFECTS ON PLANTS ARE A LOW GROWTH RATE AND DECREASED CROP YIELDS.

((MAP HERE))

COMPARISON OF INFORMATION CONCERNING POTENTIAL THREATENED, RARE OF ENDANGERED SPECIES OF FAUNA IN BELMONT COUNTY AND DATA COLLECTED IN THE RI SHOWED NO POTENTIALLY THREATENED, RARE OR ENDANGERED SPECIES OR FAUNA. ACCORDING TO THE RI, FAUNA OBSERVED IN THE AREA WERE RED FOX, WHITETAIL DEER, GREAT BLUE HERON, RABBITS, POSSUM, EASTERN GRAY SQUIRREL, STRIPED SKUNK, MICE, SONGBIRDS, AND OTHER COMMON BIRD SPECIES.

AN AQUATIC BIOTA SURVEY WAS ALSO CONDUCTED TO EVALUATE THE EFFECTS OF ANY POTENTIAL CONTAMINANT RELEASES FROM THE SITE ON AQUATIC ORGANISMS PRESENT IN STREAMS RECEIVING DRAINAGE FROM THE SITE. THE SURVEY, EXPLAINED IN THE RI, SECTION 7.0, INVOLVED CHARACTERIZATION OF FISH AND BENTHIC MACROINVERTEBRATE COMMUNITIES. THE BENTHIC INVERTEBRATE SAMPLES EXAMINED WERE DOMINATED BY POLLUTIONTOLERANT GROUPS; AND FISH SPECIES (SEE BELOW) CONSIDERED TOLERANT OF POLLUTION WERE THE ONLY SPECIES COLLECTED AT EIGHT STREAM STATIONS (SEE FIGURE 5 FOR STATION LOCATIONS).

ALL LOCATIONS SURVEYED APPEARED TO BE IMPACTED; RESULTS OF BOTH FISH AND MACROINVERTEBRATE SURVEYS DEMONSTRATED A PRONOUNCED GRADIENT IN STREAM WATER QUALITY WITH PROXIMITY TO THE SITE. STATIONS 2, 5, AND 6 EXHIBITED A SCARCITY OF BENTHIC MACROINVERTEBRATES AND ABSENCE OF FISH (REFER TO TABLE 6). THIS SUGGESTS THAT THE INSTREAM ENVIRONMENT WAS EXTREMELY POOR AT THESE STATIONS, WITH CONDITIONS AT STATION 2 LEAST FAVORABLE FOR PERSISTENCE OF LIVING ORGANISMS.

FISH WERE CAPTURED AT FIVE OF THE EIGHT STATIONS WHERE ELECTROFISHING WAS CONDUCTED, INCLUDING A SINGLE CREEK CHUB (SEMOTILUS ATROMACULATUS) FROM STATION 7 JUST DOWNSTREAM OF THE IMPOUNDMENT ON KINGS RUN. NO FISH WERE COLLECTED FROM UNNAMED RUN OR AT THE LOWER TWO STATIONS ON KINGS RUN (STATIONS 5 AND 6), WHILE FISH WERE MOST ABUNDANT IN LITTLE MCMAHON CREEK UPSTREAM OF THE CONFLUENCE WITH UNNAMED RUN AND IN KINGS RUN ABOVE THE IMPOUNDMENT, STATIONS 1 AND 8, RESPECTIVELY.

FOUR SPECIES OF FISH (REPRESENTING THREE FAMILIES) WERE TAKEN DURING STREAM ELECTROFISHING: CREEK CHUB, BLACKNOSE DACE (RHINICHTHYS ATRATULUS), WHITE SUCKER (CATOSTOMUS COMMERSONI), AN APPARENT LEPOMIS HYBRID BETWEEN GREEN SUNFISH (LEPOMIS CYANELLUS), AND PUMPKINSEED SUNFISH

(LEPOMIS GIBBOSUS). OF THESE, CREEK CHUB WAS THE MOST WIDESPREAD IN DISTRIBUTION WHILE SLIGHTLY HIGHER NUMBERS OF LEPOMIS HYBRIDS WERE TAKEN OVERALL. A SINGLE WHITE SUCKER WAS COLLECTED AT STATION 1, ON LITTLE MCMAHON CREEK UPSTREAM FROM THE UNNAMED RUN CONFLUENCE.

G. CONCLUSIONS OF THE ENDANGERMENT ASSESSMENT

TABLE 5 SUMMARIZES THE RESULTS OF THE ENDANGERMENT ASSESSMENT. THE RESULTS OF THE EA INDICATE THAT REMEDIATION IS NEEDED AS CURRENT AND POTENTIAL FUTURE EXPOSURES POSE HEALTH THREATS. CURRENT THREATS RESULT FROM INHALATION OF FUGITIVE DUST AT THE SITE ALONG WITH INCIDENTAL INGESTION OF AND DERMAL CONTACT WITH ON-SITE SOILS AT THE SITE. FUTUREUSE CARCINOGENIC AND NONCARCINOGENIC THREATS MAY OCCUR FROM DIRECT CONTACT WITH AND LONG-TERM INGESTION OF SURFACE WATER, SOILS, AND GROUND WATER AS WELL AS INHALING VOCS WHILE SHOWERING WITH CONTAMINATED WATER FROM THE SITE.

SITE RELATED IMPACTS ON THE LOCAL ENVIRONMENT WERE ASSESSED. SURVEYS OF LARGER FAUNA SHOWED NO POTENTIALLY THREATENED, RARE OR ENDANGERED SPECIES. A MACROINVERTEBRATE POPULATION SURVEY AND FISH POPULATION SURVEY DOCUMENTED THAT THE SITE WAS IMPACTING NEARBY STREAMS AND STREAM BEDS. WHERE ORGANISMS WERE PRESENT AT ALL, COMMUNITIES WERE DOMINATED BY POLLUTION-TOLERANT SPECIES. MONITORING DATA, HOWEVER, WAS UNABLE TO DISTINGUISH BETWEEN IMPACTS ON THE ENVIRONMENT POSED BY WASTE DISPOSAL PRACTICES AT THE SITE OR ACID MINE DRAINAGE EMANATING FROM THE SITE.

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THIS SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION SELECTED IN THIS RECORD OF DECISION, MAY PRESENT IMMINENT AND SUBSTANTIAL ENDANGERMENT TO PUBLIC HEALTH, WELFARE AND THE ENVIRONMENT.

VII. DESCRIPTION OF ALTERNATIVES

ALTERNATIVES FOR THE REMEDIATION OF THE **BUCKEYE RECLAMATION** LANDFILL SITE HAVE BEEN EVALUATED IN A FEASIBILITY STUDY (FS), WHICH IS AVAILABLE FOR REVIEW BY THE PUBLIC AT THE ST. CLAIRSVILLE PUBLIC LIBRARY AND AT THE NEFFS BRANCH OF THE MARTINS FERRY PUBLIC LIBRARY. THE FEASIBILITY STUDY (FS) WAS CONDUCTED TO IDENTIFY AND SCREEN TECHNOLOGIES AND ALTERNATIVES FOR ADDRESSING THE CONTAMINATION PROBLEMS AT THE SITE (FEASIBILITY STUDY, **BUCKEYE RECLAMATION** LANDFILL STEERING COMMITTEE, APRIL, 1991). THE ENDANGERMENT ASSESSMENT CONCLUDED THAT THREE SIGNIFICANT EXPOSURE AND CONTAMINANT ROUTES EXIST FOR THE **BUCKEYE RECLAMATION** SITE. THESE ROUTES ARE:

* DERMAL CONTACT / INHALATION / INGESTION OF SURFACE SOILS
* MIGRATION OF CONTAMINANTS FROM SURFACE AND SUBSURFACE SOILS INTO GROUND WATER / SURFACE WATER
* INGESTION OF CONTAMINATED GROUND WATER / SURFACE WATER.

THE FOLLOWING MEDIA, THEREFORE PRESENT AN EXISTING OR POTENTIAL FUTURE THREAT TO PUBLIC HEALTH AND THE ENVIRONMENT:

* SURFACE / SUBSURFACE SOILS
* GROUND WATER / SURFACE WATER

THE FEASIBILITY STUDY EVALUATES METHODS TO MEET REMEDIAL ACTION GOALS WHICH, BASED UPON THE EA, ARE TO PROTECT PUBLIC HEALTH AND THE ENVIRONMENT FROM CONTAMINANTS IN SOILS AND SURFACE/GROUND WATER. THIS CAN BE ACCOMPLISHED BY LIMITING DIRECT PHYSICAL CONTACT WITH THE CONTAMINATED SOILS TO REDUCE THE THREAT OF DERMAL CONTACT, INHALATION, AND INGESTION OF SOILS AND TO RESTORE THE SURFACE/GROUND WATER TO A USEFUL, LESS THREATENING STATE BY REDUCING THE LEVELS OF THE CONTAMINANTS PRESENT. SITE INVESTIGATIONS SHOW THAT MOST GROUND WATER ORIGINATING IN AQUIFERS UNDER THE **BUCKEYE RECLAMATION** SITE MIGRATES LATERALLY INTO THE COAL MINE REFUSE AND IS EVENTUALLY DISCHARGED AS LEACHATE TO KINGS RUN. IN EFFECT, MOST SITE GROUNDWATER BECOMES SURFACE WATER BEFORE IT LEAVES THE SITE. THEREFORE, GROUNDWATER AND SURFACE WATER MAY BE TREATED UNDER A SINGLE REMEDIAL ACTION OBJECTIVE.

THE INITIAL SCREENING INCLUDED FOUR ALTERNATIVES WHICH WERE EVALUATED AGAINST EFFECTIVENESS, IMPLEMENTABILITY, AND COST. THREE OF THE ORIGINAL FOUR ALTERNATIVES WERE EVALUATED IN DETAIL IN THE FEASIBILITY STUDY, ALTERNATIVES 1,3 AND 4. ALTERNATIVE 2, WHICH CONSISTED OF MONITORING AND INSTITUTIONAL CONTROLS, DID NOT MEET REMEDIAL ACTION OBJECTIVES, THEREFORE IT WAS NOT CARRIED THROUGH DETAILED ANALYSIS. ALTERNATIVE 1, THE NO-ACTION ALTERNATIVE, DOES NOT COMPLY WITH APPLICABLE AND RELEVANT OR APPROPRIATE REQUIREMENTS (ARARS - PERTINENT ENVIRONMENTAL REGULATIONS), HOWEVER IT IS RETAINED AS A STATUTORY REQUIREMENT FOR BASELINE COMPARISON TO OTHER ALTERNATIVES. THE OTHER TWO ALTERNATIVES EACH INCORPORATE TREATMENT OF LEACHATE AND GROUND WATER AS A PORTION OF THE REMEDY. TWO METHODS OF LEACHATE TREATMENT WERE EXAMINED; OPTION A - CHEMICAL TREATMENT AND OPTION B - CONSTRUCTED WETLANDS FOR EACH OF THE REMAINING ALTERNATIVES.

UNDER OPTION A, A SURFACE LEACHATE SEEP AND GROUND WATER UNDERDRAIN COLLECTION SYSTEM SHALL DISCHARGE INTO AN AERATION POND WHERE AERATION OF CARBONATES AND BICARBONATES SHALL REDUCE LIME REQUIREMENTS FOR PRECIPITATION AND ALSO REMOVE ANY VOLATILE

ORGANIC COMPOUNDS PRESENT. WATER FROM THE AERATION BASIN WOULD THEN BE TRANSFERRED TO A SETTLING BASIN THROUGH A CHANNEL, WHERE A LIME SLURRY WOULD BE ADDED. THE SETTLING POND WOULD HAVE SUFFICIENT RESIDENCE TIME TO ALLOW SETTLING OF THE METAL HYDROXIDES, CALCIUM SULFATE FORMED FROM REACTION BETWEEN THE LIME FEED AND SULFATES IN THE WATER, AND SUSPENDED TOTAL SOLIDS. TREATED WATER FROM THE SETTLING POND WOULD DISCHARGE INTO LITTLE MCMAHON CREEK THROUGH A RIPRAP-LINED CHANNEL.

UNDER OPTION B, THE SURFACE LEACHATE SEEP AND GROUND WATER UNDERDRAIN SYSTEM WOULD DISCHARGE INTO A RIPRAP LINED CHANNEL AT THE SOUTHERN END OF THE LANDFILL CAP WHICH WOULD IN TURN DISCHARGE TO A CONSTRUCTED WETLANDS. THE CHANNEL WILL BE LINED WITH LIMESTONE RIPRAP TO ASSIST IN PH ADJUSTMENT. THE WETLANDS SIZE WILL BE FROM 9 - 18 ACRES. THE ENVISIONED DESIGN INCLUDES CONSTRUCTION OF A MAXIMUM OF SIX CELLS, EACH APPROXIMATELY 3 ACRES IN SIZE. EACH CELL WOULD HAVE A 1 -FOOT BASE OF COMPACTED CLAY, A GEOMEMBRANE, SAND, CRUSHED LIMESTONE, AND ONE FOOT OF SPENT MUSHROOM COMPOST OR OTHER SUITABLE SUBSTRATE WHICH WILL BE SEEDED OR MULCHED TO ESTABLISH CATTAILS AND OTHER WETLAND VEGETATION. FLOW PATHS WOULD BE ESTABLISHED USING HAY BALES TO MAXIMIZE THE EFFECTIVE RETENTION TIME AND AVOID CHANNELIZATION OR SHORT-CIRCUITING OF THE CELLS. BACTERIA DRIVEN CHEMICAL REACTIONS IN THE WETLANDS WILL CAUSE IRON AND OTHER METALS AND CHEMICALS OF CONCERN TO DROP OUT OF SOLUTION AND LOWER THE ACIDITY OF THE WATER. THIS IS ACCOMPLISHED BY CREATING A SULFATE REDUCING ENVIRONMENT. SINCE THE LEACHATE HAS A HIGH CONCENTRATION OF SULFATE, GENERATION OF SULFIDE IN AN ANAEROBIC ENVIRONMENT IS ASSURED. UNDER THESE CONDITIONS, IRON SULFIDE (FES) PRECIPITATION SHOULD ALSO REMOVE ARSENIC AS AN ARSENIDE. WITH THE RISE IN PH TO ABOVE 6, ALUMINUM HYDROXIDE (A1(OH)((3))) WILL PRECIPITATE AND THIS WILL ALSO POSITIVELY AFFECT THE REMOVAL OF BERYLLIUM EITHER AS AN HYDROXIDE OR AN ADSORBED SPECIES. TREATED WATER FROM THE CONSTRUCTED WETLAND TREATMENT SYSTEM WOULD BE DISCHARGED TO LITTLE MCMAHON CREEK.

WETLANDS TREATMENT OF A MIXTURE OF LANDFILL LEACHATE, ACID MINE DRAINAGE AND GROUND WATER IS AN INNOVATIVE TECHNOLOGY. TREATABILITY STUDIES ARE BEING PERFORMED TO ASSESS THE EFFECTIVENESS OF THE WETLANDS TREATMENT METHOD. THE OBJECT OF THE TREATABILITY STUDIES IS TO DETERMINE IF LEVELS OF CONTAMINANTS OF CONCERN, MAINLY METALS, CAN BE LOWERED TO MEET DISCHARGE LIMITS.

ALL ALTERNATIVES ARE SUMMARIZED BELOW:

ALTERNATIVE 1 - NO ACTION

ESTIMATED CAPITAL COST:	$	0
ESTIMATED PRESENT WORTH:	$	0

ESTIMATED ANNUAL O&M COST: $ 0
ESTIMATED TIME TO IMPLEMENT NONE

THE NO ACTION ALTERNATIVE IS A NO COST ALTERNATIVE THAT IS REQUIRED TO BE RETAINED THROUGH THE DETAILED ANALYSIS OF ALTERNATIVES STAGE BY THE NATIONAL CONTINGENCY PLAN (NCP). UNDER A NO ACTION ALTERNATIVE, NO REMEDIATION OR MAINTENANCE OF THE SITE WOULD BE PERFORMED WHATSOEVER. THE SITE WOULD REMAIN IN ITS CURRENT STATE. THE NO ACTION ALTERNATIVE CAN THEREFORE BE USED AS A BASELINE FOR COMPARISON TO THE OTHER ALTERNATIVES DEVELOPED.

ALTERNATIVE 3A - FULLY RCRA COMPLIANT, SUBTITLE C CAP WITH CHEMICAL TREATMENT

ESTIMATED CAPITAL COSTS:	$184,745,000
ESTIMATED PRESENT WORTH COST:	$196,913,000
ESTIMATED ANNUAL O&M COST:	$ 834,000
ESTIMATED TIME TO IMPLEMENT:	30 MONTHS

ALTERNATIVE 3A INVOLVES THE FOLLOWING MAJOR COMPONENTS:

* RCRA COMPLIANT, HAZARDOUS WASTE CAP
* INSTITUTIONAL CONTROLS
* FENCING
* GROUND WATER COLLECTION
* SURFACE LEACHATE SEEP COLLECTION
* GROUND WATER MONITORING
* SURFACE LEACHATE SEEP MONITORING
* MONITORING OF KINGS RUN
* LEACHATE/GROUND WATER TREATMENT BY NEUTRALIZATION/ PRECIPITATION (OPTION A)

ALTERNATIVE 3A UTILIZES A FULL RCRA CAP TO CONTAIN THE ENTIRE SITE. THE CAP WILL ELIMINATE DIRECT CONTACT WITH CONTAMINATED SOILS, REDUCE INFILTRATION OF RAINWATER, AND MINIMIZE THE FORMATION OF ACID MINE AND LEACHATE DRAINAGE. A RCRA CAP CONSISTS OF THE FOLLOWING LAYERS, FROM BOTTOM TO TOP: A GRADING LAYER, A MINIMUM OF TWO FEET OF RELATIVELY IMPERMEABLE CLAY COVERED WITH A GEOMEMBRANE (RUBBERIZED SHEET), AT LEAST ONE FOOT OF SAND, AND TWO FEET OF SOIL FOR ESTABLISHING VEGETATION. SLOPES FOR A FULL RCRA CAP MUST BE 2% TO 5%. THE SLOPE REQUIREMENTS WOULD RESULT IN KINGS RUN BEING CULVERTED UNDER FILL MATERIALS. ALTERNATIVE 3A USES THE CHEMICAL TREATMENT SYSTEM TO TREAT LEACHATE AND GROUND WATER COLLECTED IN THE UNDERDRAIN COLLECTION SYSTEM. THIS ALTERNATIVE ALSO INCLUDES INSTITUTIONAL CONTROLS ON WHAT THE PROPERTY MAY BE USED FOR IN THE FUTURE, INSTALLING A FENCE AROUND THE SITE, AND PERIODIC SAMPLING OF GROUND WATER TO MONITOR CONTAMINANT MIGRATION.

ALTERNATIVE 3B - FULLY RCRA COMPLIANT CAP WITH WETLANDS TREATMENT

ESTIMATED CAPITAL COST:	$191,227,000
ESTIMATED PRESENT WORTH:	$193,084,000
ESTIMATED ANNUAL O&M COST:	$ 153,000
ESTIMATED TIME TO IMPLEMENT	30 MONTHS

THE MAJOR COMPONENTS OF ALTERNATIVE 3B ARE:

* RCRA COMPLIANT HAZARDOUS WASTE CAP
* INSTITUTIONAL CONTROLS
* FENCING
* GROUND WATER COLLECTION
* SURFACE LEACHATE SEEP COLLECTION
* GROUND WATER MONITORING
* SURFACE LEACHATE SEEP MONITORING
* MONITORING OF KINGS RUN
* LEACHATE/GROUND WATER TREATMENT BY CONSTRUCTED WETLANDS (OPTION B)

ALTERNATIVE 3B UTILIZES THE SAME TYPE OF RCRA COVER SYSTEM AND UNDERDRAIN COLLECTION SYSTEM AS 3A ABOVE, EXCEPT ALTERNATIVE 3B USES CONSTRUCTED WETLANDS TO TREAT THE COLLECTED LEACHATE AND GROUND WATER. ALL OTHER COMPONENTS ARE THE SAME AS 3A.

ALTERNATIVE 4A - SOLID WASTE (STANDARD) LANDFILL CAP WITH CHEMICAL TREATMENT

ESTIMATED CAPITAL COST:	$ 40,447,000
ESTIMATED PRESENT WORTH:	$ 52,492,000
ESTIMATED ANNUAL O&M COST:	$ 780,000
ESTIMATED TIME TO IMPLEMENT	18 MONTHS

THE MAJOR COMPONENTS OF ALTERNATIVE 4A ARE:

* SOLID WASTE LANDFILL CAP
* INSTITUTIONAL CONTROLS
* FENCING
* GROUND WATER COLLECTION
* SURFACE LEACHATE SEEP COLLECTION
* GROUND WATER MONITORING
* SURFACE LEACHATE SEEP MONITORING
* MONITORING OF KINGS RUN
* LEACHATE/GROUND WATER TREATMENT BY NEUTRALIZATION/ PRECIPITATION (OPTION A)

THIS ALTERNATIVE CONSISTS OF A SOLID WASTE LANDFILL CAP

WHICH SHOULD HAVE A FINAL SLOPE OF 5% TO 25%. OHIO SOLID WASTE REGULATIONS FOR CLOSURE OF A SOLID WASTE LANDFILL WERE USED TO DEVELOP THIS ALTERNATIVE. A SOLID WASTE CAP CONSISTS OF TWO FEET OF IMPERMEABLE CLAY, A ONE FOOT MINIMUM DRAINAGE LAYER OF SAND, AND A VEGETATED TOP LAYER WITH A MINIMUM THICKNESS OF TWO FEET. KINGS RUN WILL REMAIN IN PLACE AND THE WESTERN BANK WILL BE LINED WITH RIPRAP TO CONTROL EROSION. A LEACHATE AND GROUND WATER COLLECTION SYSTEM WILL BE INSTALLED TO INTERCEPT ACID MINE DRAINAGE (AMD) AND LEACHATE FROM THE LANDFILLED AREAS AND CHANNEL IT TO THE TREATMENT SYSTEM. THE AMD AND LEACHATE WILL BE TREATED WITH HYDRATED LIME IN THE TREATMENT SYSTEM. ALSO INCLUDED IN THIS OPTION ARE INSTITUTIONAL CONTROLS ON FUTURE PROPERTY USE, INSTALLING OF A FENCE AROUND THE SITE, AND GROUND WATER MONITORING FOR CONTAMINANT MIGRATION.

ALTERNATIVE 4B - SOLID WASTE (STANDARD) LANDFILL CAP WITH WETLANDS TREATMENT

ESTIMATED CAPITAL COST:	$ 46,923,000
ESTIMATED PRESENT WORTH:	$ 48,663,000
ESTIMATED ANNUAL O&M COST:	$ 99,000
ESTIMATED TIME TO IMPLEMENT	18 MONTHS

THE MAJOR COMPONENTS OF ALTERNATIVE 4B ARE:

* SOLID WASTE LANDFILL CAP
* INSTITUTIONAL CONTROLS
* FENCING
* GROUND WATER COLLECTION
* SURFACE LEACHATE SEEP COLLECTION
* GROUND WATER MONITORING
* SURFACE LEACHATE SEEP MONITORING
* MONITORING OF KINGS RUN
* LEACHATE/GROUND WATER TREATMENT BY CONSTRUCTED WETLANDS (OPTION B)

ALTERNATIVE 4B IS THE SAME AS 4A EXCEPT AMD, LEACHATE AND GROUND WATER COLLECTED BY THE UNDERDRAIN SYSTEM WILL BE TREATED BY THE CONSTRUCTED WETLANDS. ALL OTHER COMPONENTS ARE SIMILAR.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

THE REMEDIAL ALTERNATIVES DEVELOPED DURING THE FEASIBILITY STUDY WERE EVALUATED BY THE U.S. EPA USING THE FOLLOWING NINE CRITERIA. THE ADVANTAGES AND DISADVANTAGES OF EACH ALTERNATIVE WERE THEN COMPARED TO DETERMINE WHICH ALTERNATIVE PROVIDED THE BEST BALANCE AMONG THESE NINE CRITERIA. THESE CRITERIA ARE SET FORTH IN THE NATIONAL CONTINGENCY PLAN, 40 CFR PART 300.430.

1. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT ADDRESSES WHETHER OR NOT A REMEDY PROVIDES ADEQUATE PROTECTION, AND DESCRIBES HOW RISKS ARE ELIMINATED, REDUCED OR CONTROLLED THROUGH TREATMENT, ENGINEERING CONTROLS, OR INSTITUTIONAL CONTROLS.

2. COMPLIANCE WITH ARARS ADDRESSES WHETHER OR NOT A REMEDY WILL MEET ALL OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) OF OTHER ENVIRONMENTAL STATUTES AND/OR PROVIDE GROUNDS FOR INVOKING A WAIVER.

3. LONG-TERM EFFECTIVENESS AND PERMANENCE REFERS TO THE ABILITY OF A REMEDY TO MAINTAIN RELIABLE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT OVER TIME ONCE CLEANUP GOALS HAVE BEEN MET.

4. REDUCTION OF TOXICITY, MOBILITY, OR VOLUME IS THE ANTICIPATED PERFORMANCE OF THE TREATMENT TECHNOLOGIES A REMEDY MAY EMPLOY.

5. SHORT-TERM EFFECTIVENESS INVOLVES THE PERIOD OF TIME NEEDED TO ACHIEVE PROTECTION AND ANY ADVERSE IMPACTS ON HUMAN HEALTH AND THE ENVIRONMENT THAT MAY BE POSED DURING THE CONSTRUCTION AND IMPLEMENTATION PERIOD UNTIL CLEANUP GOALS ARE ACHIEVED.

6. IMPLEMENTABILITY IS THE TECHNICAL AND ADMINISTRATIVE FEASIBILITY OF A REMEDY, INCLUDING THE AVAILABILITY OF GOODS AND SERVICES NEEDED TO IMPLEMENT THE CHOSEN SOLUTION.

7. COST INCLUDES CAPITAL AND OPERATION AND MAINTENANCE COSTS.

8. STATE AGENCY ACCEPTANCE INCLUDES WHETHER, BASED ON ITS REVIEW OF THE RI/FS AND PROPOSED PLAN, THE STATE AGENCY (OEPA) CONCURS, OPPOSES, OR HAS NO COMMENT ON THE PREFERRED ALTERNATIVE.

9. COMMUNITY ACCEPTANCE WILL BE ASSESSED IN THE RECORD OF DECISION FOLLOWING A REVIEW OF THE PUBLIC COMMENTS RECEIVED ON THE RI/FS REPORT AND THE PROPOSED PLAN.

EACH ALTERNATIVE WAS EVALUATED AGAINST THESE NINE CRITERIA. THE SELECTED ALTERNATIVE IS ALTERNATIVE 4B, A STANDARD, OR SOLID WASTE LANDFILL CAP, WITH WETLANDS TREATMENT OF COLLECTED LEACHATE, ACID MINE DRAINAGE AND GROUND WATER. A DISCUSSION OF HOW THE ALTERNATIVES COMPARE TO EACH OTHER BASED UPON THESE CRITERIA FOLLOWS.

CRITERION 1. OVERALL PROTECTION OF HUMAN HEALTH AND THE

ENVIRONMENT

ALL OF THE REMEDIAL ALTERNATIVES CONSIDERED FOR THE SITE, EXCEPT FOR THE NO ACTION ALTERNATIVE AND THE INSTITUTIONAL CONTROLS ALTERNATIVE, ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. THIS PROTECTION IS ACHIEVED BY ELIMINATING, REDUCING OR CONTROLLING RISKS THROUGH COMBINATIONS OF TREATMENT, ENGINEERING CONTROLS AND INSTITUTIONAL CONTROLS. AS THE NO-ACTION ALTERNATIVE AND ALTERNATIVE 2, THE INSTITUTIONAL CONTROLS ALTERNATIVE, DO NOT PROVIDE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT, THEY ARE NOT ELIGIBLE FOR SELECTION AND SHALL NOT BE DISCUSSED FURTHER IN THIS DOCUMENT.

ALTERNATIVES 3 AND 4 WOULD PROVIDE PROTECTION TO TRESPASSERS ON SITE BECAUSE THE LANDFILL CAPS WOULD COVER CONTAMINATED SOILS THUS ELIMINATING EXPOSURE TO THE SOILS. COLLECTION OF LANDFILL LEACHATE, GROUND WATER AND ACID MINE DRAINAGE WOULD ELIMINATE UNCONTROLLED RELEASES OF CONTAMINANTS TO THE ENVIRONMENT, THEREBY MINIMIZING THE CHANCE OF EXPOSURE. TREATMENT OF THE LEACHATE, GROUNDWATER, AND ACID MINE DRAINAGE WILL CONVERT CONTAMINANTS IN THESE LIQUIDS TO MORE STABLE FORMS AND REMOVE THE CONTAMINANTS FROM SOLUTION.

CRITERION 2. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

SECTION 121 (D) OF SARA REQUIRES THAT REMEDIAL ACTIONS MEET LEGALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) OF OTHER ENVIRONMENTAL LAWS. THESE LAWS MAY INCLUDE: THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), THE CLEAN WATER ACT (CWA), THE CLEAN AIR ACT (CAA), THE SAFE DRINKING WATER ACT (SDWA), AND ANY STATE LAW WHICH HAS MORE STRINGENT REQUIREMENTS THAN THE CORRESPONDING FEDERAL LAW. 'LEGALLY APPLICABLE' REQUIREMENTS ARE THOSE CLEANUP STANDARDS, STANDARDS OF CONTROL, AND OTHER SUBSTANTIVE ENVIRONMENTAL PROTECTION REQUIREMENTS, CRITERIA OR LIMITATIONS PROMULGATED UNDER FEDERAL OR STATE LAW THAT SPECIFICALLY ADDRESS A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION, LOCATION, OR OTHER CIRCUMSTANCES AT A CERCLA SITE. 'RELEVANT AND APPROPRIATE' REQUIREMENTS ARE THOSE REQUIREMENTS THAT, WHILE NOT LEGALLY APPLICABLE TO THE REMEDIAL ACTION, ADDRESS PROBLEMS OR SITUATIONS SUFFICIENTLY SIMILAR TO THOSE ENCOUNTERED AT THE SITE THAT THEIR APPLICATION IS WELL SUITED TO THE REMEDIAL ACTION.

NON-PROMULGATED ADVISORIES OR GUIDANCE DOCUMENTS ISSUED BY FEDERAL OR STATE GOVERNMENTS DO NOT HAVE THE STATUS OF ARARS; HOWEVER, WHERE NO APPLICABLE OR RELEVANT AND

APPROPRIATE REQUIREMENTS EXIST, OR FOR SOME REASON MAY NOT BE SUFFICIENTLY PROTECTIVE, NON-PROMULGATED ADVISORIES OR GUIDANCE DOCUMENTS MAY BE CONSIDERED IN DETERMINING THE NECESSARY LEVEL OF CLEAN UP FOR PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT.

SEVERAL SPECIFIC ARARS ARE DISCUSSED BELOW.

A) RESOURCE CONSERVATION AND RECOVERY ACT (RCRA). RCRA CHARACTERISTIC WASTES (CORROSIVE; D002 AND EP TOXIC) WERE DISPOSED IN A LIMITED PORTION OF THE **BUCKEYE RECLAMATION** LANDFILL (BRL) SITE, PRIOR TO 1980. U.S. EPA IS IMPLEMENTING A WAIVER OF RCRA LANDFILL CLOSURE REQUIREMENTS PURSUANT TO CERCLA SECTION 121(D)(4)(C) AND (D) AND 40 CFR 300.430(F)(1)(II)(C), DUE TO THE STEEPNESS OF THE SLOPES PRESENT AT THE BRL SITE. SECTIONS 121(D)(4)(C) PROVIDE U.S. EPA AUTHORITY TO WAIVE A REQUIREMENT WHEN 'COMPLIANCE WITH SUCH REQUIREMENT IS TECHNICALLY IMPRACTICABLE FROM AN ENGINEERING PERSPECTIVE'. SLOPE REQUIREMENTS FOR THE SUBTITLE C CAP CANNOT BE REASONABLY IMPLEMENTED AT THIS SITE BECAUSE FILLING THE VALLEY WOULD BE REQUIRED AND KINGS RUN WOULD BE DIVERTED THROUGH PIPES UNDER THE CAP. INASMUCH AS THE SUBTITLE C CAP IS TECHNICALLY IMPRACTICABLE, FROM BOTH AN ENGINEERING AND RELIABILITY PERSPECTIVE, A WAIVER OF THE RCRA CLOSURE REQUIREMENTS PURSUANT TO CERCLA 121(D)(4)(D) IS ALSO JUSTIFIED. THIS SECTION PROVIDES U.S. EPA AUTHORITY TO WAIVE A REQUIREMENT WHEN 'THE ALTERNATIVE WILL ATTAIN A STANDARD OF PERFORMANCE THAT IS EQUIVALENT TO THAT REQUIRED UNDER THE OTHERWISE APPLICABLE STANDARD, REQUIREMENT, OR LIMITATION THROUGH USE OF ANOTHER METHOD OR APPROACH'. A SUBTITLE C CAP AT THE BRL SITE IS TECHNICALLY IMPRACTICABLE AND A SOLID WASTE CAP WILL ATTAIN A STANDARD OF PERFORMANCE EQUIVALENT TO OR GREATER THAN RCRA CAP REQUIREMENTS FOR THE FOLLOWING REASONS:

1) THE STEEP SLOPES OF THE AREA TO BE CAPPED AT THE **BUCKEYE RECLAMATION** LANDFILL WILL HAVE TO BE REDUCED SIGNIFICANTLY (TO 2-5%) IN ORDER TO CONSTRUCT THE RCRA CAP. IF IT IS NOT POSSIBLE TO DECREASE THE SLOPES TO THIS LEVEL, COVER MATERIALS PLACED OVER THE SYNTHETIC LINER, WHICH IS REQUIRED FOR A RCRA CAP, MAY BECOME UNSTABLE WHEN SATURATED AND CONTRIBUTE TO SYNTHETIC LINER FAILURE AND POSSIBLE SUBSEQUENT CAP FAILURE. SINCE THE SOLID WASTE CAP CAN BE IMPLEMENTED OVER STEEPER SLOPES (5-25%) AND DOES NOT REQUIRE SUCH LINERS, THE LIKELIHOOD OF A SOLID WASTE CAP FAILURE AT THIS SITE IS SIGNIFICANTLY DECREASED. THEREFORE, THE SOLID WASTE CAP REQUIREMENTS ARE LIKELY TO RESULT IN IMPROVED PERFORMANCE OF THE REMEDIAL ACTION.

2) IMPLEMENTATION OF THE RCRA CAP WILL REQUIRE EXCAVATION OF LARGE VOLUMES OF WASTE MATERIAL IN ORDER TO MEET RCRA SLOPE REQUIREMENTS. THE EXCAVATION OF WASTE WILL INCREASE THE LIKELIHOOD OF HUMAN EXPOSURE TO HAZARDOUS SUBSTANCES. SINCE THE SOLID WASTE CAP CAN BE IMPLEMENTED OVER STEEPER SLOPES, A MUCH LOWER VOLUME OF WASTE WILL HAVE TO BE EXCAVATED DURING REMEDIAL CONSTRUCTION. THUS, IMPLEMENTATION OF THE SOLID WASTE CAP WILL ACHIEVE ENHANCED PERFORMANCE FROM THE PERSPECTIVE OF OVERALL CONTROL OF RISK.

3) IMPLEMENTATION OF THE RCRA CAP WILL REQUIRE CULVERTING KINGS RUN UNDER THE CAP. ALLOWING WATER TO FLOW UNDER THE CAP WILL INCREASE THE POTENTIAL FOR INFILTRATION OF SUCH WATER INTO THE CAPPED WASTE MATERIAL (POTENTIALLY INCREASING THE AMOUNT OF GROUND WATER CONTAMINATION AND LEACHATE PRODUCTION). HOWEVER, THE SOLID WASTE CAP CAN BE IMPLEMENTED WITHOUT CULVERTING KINGS RUN. THEREFORE, THE SOLID WASTE CAP WILL DECREASE THE POTENTIAL FOR INCREASED INFILTRATION, CONTAMINANT MIGRATION, AND LEACHATE PRODUCTION FROM THE CULVERTED STREAM.

B) OHIO ADMINISTRATIVE CODE (OAC) 3745-27-11, FINAL CLOSURE OF SANITARY LANDFILL FACILITIES. THE SELECTED REMEDY WILL MEET OR EXCEED THE REQUIREMENTS OF THIS RULE BY INSTALLING THE SPECIFIED CAP AND SURFACE WATER DIVERSION CONTROLS. THE CAP SHALL BE INSTALLED OVER ALL AREAS WHERE WASTE DISPOSAL OCCURRED AND UP GRADIENT AREAS WHICH COULD ACT AS RECHARGE ZONES TO SITE GROUND WATERS. THE IMPERMEABLE LAYER OF THE CAP MUST NOT EXCEED 1X10((-7)) CM/SEC. PERMEABILITY AND THE LAYERS MUST MEET THE MINIMUM THICKNESS REQUIREMENTS.

C) OAC 3745-27-10, GROUND WATER MONITORING PROGRAM. THE SELECTED REMEDY INCLUDES A GROUND WATER MONITORING PROGRAM WHICH WILL ASSURE NO CONTAMINANTS ARE LEAVING THE SITE. POINTS OF GROUND WATER COMPLIANCE ARE CONSIDERED TO BE THE LANDFILL BOUNDARIES.

D) OAC 3745-27-14, POST CLOSURE CARE OF SANITARY LANDFILL FACILITIES. POST CLOSURE CARE WILL CONTINUE FOR A MINIMUM OF 30 YEARS AFTER THE CLOSURE DATE. POST CLOSURE CARE INVOLVES LEACHATE COLLECTION AND MANAGEMENT, SURFACE WATER MANAGEMENT, GROUND WATER MONITORING, REGULAR INSPECTIONS OF THE CAP FOR EROSION, SUBSIDENCE, AND/OR SETTLEMENT, AND PERIODIC MAINTENANCE SUCH AS REPAIR OF ANY EROSION DAMAGE TO THE CAP OR ANY OF THE DRAINAGE CHANNELS FROM SURFACE WATER

RUNOFF.

E) OHIO REVISED CODE (ORC) CHAPTER 6111, WATER POLLUTION CONTROL LAW. TREATMENT OF THE COLLECTED LEACHATE AND GROUND WATER WILL RESTORE THE QUALITY OF WATERS LEAVING THE SITE IN ACCORDANCE WITH THIS LAW.

F) NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES). THE TREATMENT SYSTEM IS EXPECTED TO BE LOCATED ON-SITE, OR IN NEAR PROXIMITY TO THE SITE. CONSEQUENTLY, THE ADMINISTRATIVE REQUIREMENTS OF AN NPDES PERMIT AND PERMITTO-INSTALL NEED NOT BE MET. HOWEVER, SUBSTANTIVE REQUIREMENTS SUCH AS DESIGN STANDARDS AND EFFLUENT DISCHARGE LIMITS MUST BE ADHERED TO. INTERIM LIMITS FOR THE WETLANDS DISCHARGE HAVE BEEN CALCULATED BASED ON WATER QUALITY STANDARDS (SEE ATTACHMENT A). THESE LIMITS MAY BE MADE MORE STRINGENT BASED UPON THE PERFORMANCE OF THE WETLANDS SYSTEM. SHOULD THE TREATMENT SYSTEM BE LOCATED OFF-SITE, THE FULL NPDES PERMIT AND PTI WILL BE REQUIRED.

G) ANY SLUDGE GENERATED BY THE CHEMICAL/PHYSICAL TREATMENT SYSTEM OR THE WETLANDS TREATMENT SYSTEM, WHETHER THE SYSTEM IS LOCATED ON-SITE OR OFF-SITE, WILL NEED TO BE EVALUATED PURSUANT TO OAC 3745-52-11 AS A POTENTIAL HAZARDOUS WASTE.

CRITERION 3. LONG-TERM EFFECTIVENESS AND PERMANENCE

CAPPING IS A RELIABLE TECHNOLOGY FOR ISOLATING CONTAMINATION FROM THE SURFACE ENVIRONMENT AND MINIMIZING INFILTRATION OF PRECIPITATION. WITH INFILTRATION MINIMIZED, LEACHATE GENERATION SHOULD BE MINIMIZED. THE RCRA MULTI-LAYER CAP WILL REQUIRE MORE INVOLVED INSPECTION AND MAINTENANCE TO ASSURE LONG-TERM PERFORMANCE. THE RCRA CAP WOULD ALSO COVER A PORTION OF KINGS RUN, BECAUSE OF THE SLOPE REQUIREMENTS. KINGS RUN WOULD THEN BE CHANNELED THROUGH CULVERTS UNDER THE CAP. THIS WOULD RESULT IN LOSS OF SOME SURFACE WATER WILDLIFE HABITAT AND INVOLVE COMPLICATED INSPECTION AND MAINTENANCE OF THE CULVERTS. WETLANDS TREATMENT OF THE COLLECTED LEACHATE/GROUNDWATER SHOULD PROVE MORE EFFECTIVE OVER THE LONG TERM BECAUSE, ONCE ESTABLISHED, THE WETLANDS SHOULD BE A SELF CONTAINED SYSTEM. BACTERIA IN THE ANAEROBIC SUBSTRATE SHOULD REPRODUCE, FEEDING ON THE INFLOW OF SULFATE-RICH LEACHATE. WITH THE SITE CAPPED AND LEACHATE GENERATION FROM THE SITE DECREASING, REQUIRED CAPACITY FOR THE WETLANDS TREATMENT SHOULD ALSO DECREASE. IN EFFECT, LONG-TERM EFFECTIVENESS OF THE WETLANDS TREATMENT SHOULD INCREASE WITH TIME. ANY COMBINATION OF THE ABOVE ALTERNATIVES WILL INCREASE WATER QUALITY IN THE AREA OF THE SITE, WHICH WILL BENEFIT SURFACE WATER WILDLIFE HABITATS.

CRITERION 4. REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT

ALTERNATIVES 3 AND 4 WILL BOTH INCLUDE TREATMENT OF COLLECTED LEACHATE/GROUND WATER. EITHER OF THE TWO TREATMENT OPTIONS WILL REDUCE THE MOBILITY OF THE CONTAMINANTS OF CONCERN BY CONVERTING THE COMPOUNDS TO A MORE CHEMICALLY STABLE SPECIES. BY PHYSICALLY ELIMINATING DISCHARGES TO KINGS RUN WITH THE LEACHATE/GROUND WATER COLLECTION SYSTEM, THE TOTAL VOLUME OF CONTAMINATED WATERS WILL BE GREATLY DECREASED. CAPPING THE SITE WILL MINIMIZE LEACHATE GENERATION AS WATER-BEARING ZONES UNDER THE SITE DEWATER.

OPTIONS FOR TREATING WASTE PIT SOILS, INCLUDING INCINERATION AND SOLIDIFICATION/STABILIZATION, WERE EVALUATED IN THE FEASIBILITY STUDY. BOTH TREATMENT OPTIONS WERE ELIMINATED DURING THE PHASE TWO SCREENING PROCESS DUE TO THE TYPES OF CONTAMINANTS WHICH ARE PRESENT IN THE SOILS, DIFFICULTIES IN IMPLEMENTING THE TREATMENTS, SHORT-TERM HEALTH RISKS INVOLVED IN DIGGING UP THE CONTAMINATED SOILS AND THE HIGH COST VERSUS LITTLE OVERALL ENVIRONMENTAL BENEFIT OF TREATMENT. INCINERATION EFFECTIVELY DESTROYS ORGANIC CONTAMINANTS BUT LEAVES METALS IN THE ASH, WHICH WOULD REQUIRE FURTHER TREATMENT BEFORE DISPOSAL. SOLIDIFICATION/ STABILIZATION WOULD IMMOBILIZE THE METAL CONTAMINANTS BUT MAY NOT ADDRESS THE ORGANIC CONTAMINANTS. BASED ON THE ABOVE FACTORS, THE AGENCY DETERMINED THAT TREATMENT OF THE WASTE PIT SOILS WOULD NOT BE PART OF THE REMEDY FOR THE BRL SITE.

CRITERION 5. SHORT-TERM EFFECTIVENESS

THE STANDARD OR SOLID WASTE LANDFILL CAP PROPOSED IN ALTERNATIVE 4 REQUIRES FAR LESS EARTH MOVING ACTIVITIES (APPROXIMATELY 1.3 MILLION CUBIC YARDS) AND AN ESTIMATED 18 MONTHS FOR CONSTRUCTION. ALTERNATIVE 3, THE RCRA CAP, INVOLVES EXTENSIVE EARTH MOVING ACTIVITIES (APPROXIMATELY 11 MILLION CUBIC YARDS) AND AN ESTIMATED 30 MONTHS FOR CONSTRUCTION BECAUSE OF THE 2% TO 5% SLOPE REQUIREMENT. EACH OF THE CAP TYPES WILL LIKELY USE SOME CUT AND FILL OF LANDFILLED AREAS TO MEET SLOPE REQUIREMENTS, HOWEVER, THE STANDARD CAP REQUIRES LESS EXCAVATION AND TIME, DECREASING THE AMOUNT OF EXPOSURE TO CONTAMINATED SOILS. INSTALLATION OF THE RCRA CAP WOULD COVER THE NORTHERN PORTIONS OF KINGS RUN, THEREFORE NECESSITATING CULVERTING THOSE PORTIONS OF THE STREAM. THIS WOULD REQUIRE MORE EXTENSIVE SURFACE WATER RUNOFF MANAGEMENT BECAUSE SURFACE RUNOFF WOULD NEED TO BE ROUTED TO THE SOUTHERN PORTIONS OF KINGS RUN WHERE IT IS NOT CULVERTED. THE IMPLEMENTATION OF THE PREFERRED ALTERNATIVE

UTILIZING THE LEACHATE/GROUND WATER COLLECTION WITH EITHER WATER TREATMENT OPTION A OR B IS NOT EXPECTED TO HAVE A SIGNIFICANT DETRIMENTAL IMPACT ON THE ENVIRONMENT. IT SHOULD PRODUCE AN IMMEDIATE ENVIRONMENTAL BENEFIT BY SIGNIFICANTLY REDUCING OR ELIMINATING THE QUANTITY AND CONCENTRATION OF THE CONTAMINATED WASTE/LEACHATE THAT IS CURRENTLY BEING RELEASED TO LOCAL SURFACE WATERS.

CRITERION 6. IMPLEMENTABILITY

EACH OF THE ALTERNATIVES CONSIDERED IS IMPLEMENTABLE. THE TECHNOLOGIES OF EXCAVATION AND CAPPING HAVE BEEN WELL PROVEN, AND HAVE BEEN EXTENSIVELY PRACTICED ON HAZARDOUS WASTE SITES IN THE PAST. ALTERNATIVE 4 IS MORE READILY IMPLEMENTABLE BECAUSE LESS CULVERTING AND DIVERTING OF STREAMS IS INVOLVED AND LESS EARTH/WASTE MOVEMENT WILL BE NECESSARY. THE PROPOSED GROUND WATER AND SURFACE LEACHATE SEEP COLLECTION TECHNOLOGIES ARE READILY IMPLEMENTABLE AT THE BRL SITE. IMPLEMENTATION OF THE GROUND WATER AND SURFACE LEACHATE SEEP TREATMENT BY PRECIPITATION/ NEUTRALIZATION CAN ALSO BE READILY IMPLEMENTABLE. SUFFICIENT AREA IS AVAILABLE FOR THE CONSTRUCTION OF THIS OPTION. AS WETLANDS TREATMENT REQUIRES MORE SPACE (APPROXIMATELY 9-18 ACRES), SITE TOPOGRAPHY NEEDS TO BE CAREFULLY EVALUATED DURING THE REMEDIAL DESIGN PHASE. A TREATABILITY STUDY IS CURRENTLY BEING CONDUCTED TO EVALUATE THE EFFECTIVENESS OF THE WETLANDS TREATMENT FOR REMOVAL OF THE CONTAMINANTS OF CONCERN.

IMPLEMENTATION OF ALTERNATIVE 3 WOULD BE EXPECTED TO TAKE A MINIMUM OF 30 MONTHS WHEREAS ALTERNATIVE 4 WOULD TAKE 18 MONTHS. CONSTRUCTION SCHEDULES COULD BE DELAYED BASED ON WEATHER CONDITIONS AS WELL AS CONSTRUCTION-RELATED FACTORS.

CRITERION 7. COST

ALTERNATIVE 4 COSTS ARE ESTIMATED TO RANGE FROM $52,492,000 TO $48,663,000, WITH OPTION A OR B, RESPECTIVELY. ALTERNATIVE 4B IS THE LEAST EXPENSIVE REMEDY WHICH IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND MEETS ARARS. THE COST OF ALTERNATIVE 3 RANGES FROM $196,913,000 TO $193,084,000 WITH TREATMENT OPTION A OR B, RESPECTIVELY.

CRITERION 8. STATE ACCEPTANCE

THE OHIO ENVIRONMENTAL PROTECTION AGENCY (OHIO EPA) HAS BEEN CLOSELY INVOLVED WITH THE DEVELOPMENT AND REVIEW OF ALL ASPECTS OF THE REMEDIAL INVESTIGATION, FEASIBILITY STUDY, ENDANGERMENT ASSESSMENT, AND ALL RELATED DOCUMENTS FOR THIS SITE AS A PARTY TO THE AOC UNDER WHICH THE RI/FS WAS

PERFORMED. THE OHIO EPA HAS ALSO BEEN CLOSELY INVOLVED IN THE REMEDY SELECTION PROCESS. THE PROPOSED PLAN WAS ISSUED AS A JOINT PROPOSAL OF THE U.S. EPA AND OHIO EPA.

A LETTER FROM THE DIRECTOR OF THE OHIO EPA INDICATING OHIO EPA'S CONCURRENCE ON THIS RECORD OF DECISION HAS BEEN RECEIVED BY THE U.S. EPA.

CRITERION 9. COMMUNITY ACCEPTANCE

WRITTEN COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND ORAL COMMENTS TAKEN DURING THE PROPOSED PLAN PUBLIC MEETING HAVE BEEN CONSIDERED BY THE U.S. EPA.

SEVERAL MEMBERS OF THE COMMUNITY EXPRESSED CONCERNS THAT THE COST OF THE PROPOSED REMEDY WOULD RAISE THEIR TAXES AND/OR BANKRUPT COMPANIES RESPONSIBLE FOR THE CLEANUP. OTHER MEMBERS OF THE COMMUNITY WERE NOT CONVINCED THAT THE SITE ACTUALLY POSED A HEALTH RISK, THEREFORE STATING THAT ANY REMEDIAL COSTS WERE NOT JUSTIFIED. COMMENTS SUBMITTED BY THE PRP GROUP WHICH CONDUCTED THE RI/FS UNDER THE AGENCIES' OVERSIGHT STATED THAT SEVERAL ASSUMPTIONS USED IN THE ENDANGERMENT ASSESSMENT WERE OVERLY CONSERVATIVE. ALL OF THE PUBLIC COMMENTS RECEIVED ARE ADDRESSED IN THE RESPONSIVENESS SUMMARY WHICH IS ATTACHED TO THIS RECORD OF DECISION (ROD).

AFTER CONSIDERING PUBLIC COMMENTS, THE U.S. EPA DETERMINED THAT PUBLIC HEALTH AND THE ENVIRONMENT ARE AT RISK FROM SITE RELATED CONTAMINATION. THEREFORE, PUBLIC HEALTH AND THE ENVIRONMENT WOULD BE BETTER SERVED BY FINALIZING THE ROD IN ITS PRESENT FORM SO THAT IMPLEMENTATION OF THE REMEDY COULD BEGIN.

IN SUMMARY, THE U.S. EPA HAS DETERMINED THAT THE SELECTED ALTERNATIVE PROVIDES THE BEST BALANCE WITH RESPECT TO THE NINE CRITERIA USED TO EVALUATE REMEDIES. BASED UPON THE INFORMATION AVAILABLE AT THIS TIME, THEREFORE, THE U.S. EPA AND THE OEPA BELIEVE THAT THE SELECTED ALTERNATIVE WOULD PROTECT HUMAN HEALTH AND THE ENVIRONMENT, WOULD COMPLY WITH ARARS AS QUALIFIED ABOVE, WOULD BE COST-EFFECTIVE, AND WOULD UTILIZE PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. THE SELECTED ALTERNATIVE WILL SATISFY THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT BY UTILIZING WETLANDS TREATMENT OF COLLECTED LEACHATE AND GROUND WATER. A FULL RESPONSIVENESS SUMMARY TO ALL COMMENTS RECEIVED BY U.S. EPA IS ATTACHED.

IX. SELECTED REMEDY

THE SELECTED ALTERNATIVE, DETAILED DESCRIPTION

THE SELECTED ALTERNATIVE AT THE **BUCKEYE RECLAMATION** LANDFILL SITE IS ALTERNATIVE 4B, WHICH INVOLVES THE FOLLOWING:

* SOLID WASTE LANDFILL CAP
* INSTITUTIONAL CONTROLS
* FENCING
* GROUND WATER COLLECTION
* SURFACE LEACHATE SEEP COLLECTION
* GROUND WATER MONITORING
* SURFACE LEACHATE SEEP MONITORING
* MONITORING OF KINGS RUN
* LEACHATE/GROUND WATER TREATMENT BY CONSTRUCTED WETLANDS (OPTION B)

DETAILS ON EACH COMPONENT OF THE ALTERNATIVE ARE GIVEN BELOW. THE REMEDIATION GOALS FOR THIS SELECTED ALTERNATIVE WERE BASED ON CURRENT AND POTENTIAL FUTURE-USE RISKS POSED BY THE SITE WHICH WERE DEVELOPED IN THE BRL ENDANGERMENT ASSESSMENT. STATE OF OHIO SOLID WASTE CLOSURE REGULATIONS WERE ALSO CONSIDERED IN SELECTING THIS ALTERNATIVE.

SOLID WASTE LANDFILL CAP

THIS ALTERNATIVE INVOLVES LEAVING THE WASTE PIT MATERIAL IN PLACE AND COVERING THE ENTIRE LANDFILLED AREA, THE WASTE PIT, AND SUSPECTED SOURCES OF RECHARGE FOR THE WASTE PIT AND WATER-BEARING ZONES POTENTIALLY IN CONTACT WITH IT WITH A SOLID WASTE LANDFILL CAP (FIGURE 6). THE PURPOSE OF THE CAP WOULD BE TO MINIMIZE INFILTRATION OF PRECIPITATION THROUGH THE LANDFILLED MATERIAL, MINIMIZE HUMAN AND ANIMAL CONTACT WITH THE LANDFILLED MATERIAL, CONTROL SURFACE FLUSHING OF ACID-PRODUCING MATERIAL BY AIR AND WATER EROSION. THE CAP WILL ALSO MINIMIZE CONTAMINATION OF SURFACE WATER RUNOFF AND THE DISPERSION OF HAZARDOUS WASTES AND CONTAMINATED SURFACE SOIL BY WIND. THIS ALTERNATIVE REQUIRES LIMITED CUT AND FILL VOLUMES AND FEWER CAP MATERIALS. A SOLID WASTE CAP IS PREFERRED OVER A CAP WITH A GEOMEMBRANE BECAUSE, FOR THE SITE CONDITIONS AT BUCKEYE, IT WOULD BE AS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, MORE STABLE ON THE STEEPER SLOPES AND LESS COSTLY TO CONSTRUCT, INSPECT AND MAINTAIN.

A SOLID WASTE LANDFILL CAP (FIGURE 6) CONSISTS OF A VEGETATED TOP COVER, A MIDDLE DRAINAGE LAYER, AND LOW PERMEABILITY LAYER. THE MATERIAL CONSTITUTING THE LOW PERMEABILITY LAYER MUST NOT EXCEED 10((-7)) CM/SEC. PERMEABILITY. THIS DESIGN FOR A SOLID WASTE LANDFILL CAP IS SPECIFIED BY THE OHIO ADMINISTRATIVE CODE (OAC) 3745-2711. ALL SOLID WASTE LANDFILLS IN OHIO MUST BE CLOSED IN ACCORDANCE WITH THIS REGULATION. THE VEGETATED TOP LAYER WILL HAVE A MINIMUM THICKNESS OF TWO FEET AND CONSIST OF TOPSOIL THAT

CAN SUPPORT VEGETATION. A WELL-MIXED COVER OF GRASSES AND LEGUMES SUCH AS KENTUCKY BLUEGRASS, CLOVER, AND RED TOP WILL PROVIDE DENSE ROOT SYSTEM TO ANCHOR THE SOIL AND MINIMIZE WIND AND WATER EROSION. THE DRAINAGE LAYER IS LOCATED DIRECTLY BELOW THE VEGETATED TOP LAYER AND HAS A MINIMUM THICKNESS OF ONE FOOT. THE LOW PERMEABILITY LAYER WILL CONSIST OF A LOW PERMEABILITY SOIL WITH A MINIMUM THICKNESS OF TWO FEET. THIS LOW PERMEABILITY SOIL LAYER MINIMIZES THE AMOUNT OF INFILTRATION TO THE CAPPED MATERIAL.

((MAP HERE))

TO PROTECT THE WEST BANK OF KINGS RUN FROM FURTHER EROSION AND PRESERVE THE INTEGRITY OF THE CAP, THE WEST BANK WILL BE LINED WITH A LAYER OF STONES CALLED RIPRAP. THE CHANNEL WILL BE LINED WITH AN 18 INCH BLANKET OF GRADED RIPRAP (AROUND 12 INCHES IN DIAMETER) THAT WILL EXTEND APPROXIMATELY 7 FEET UP THE WEST BANK OF KINGS RUN AND ALONG THE STREAM BOTTOM. A NON-WOVEN GEOTEXTILE WILL BE INSTALLED BETWEEN THE SOIL AND THE RIPRAP TO MINIMIZE SOIL MOVEMENT INTO OR THROUGH THE RIPRAP.

DRAINAGE CHANNELS WILL BE INSTALLED TO THE NORTH AND WEST OF THE CAP TO COLLECT SURFACE WATER RUNOFF FROM THE CAP AND DIVERT IT AWAY FROM THE CAP TO PROTECT IT FROM EROSION. NORTH-SOUTH BERMS WILL BE CONSTRUCTED AT ALL MAJOR SLOPE BREAKS ON THE CAP. THE BERMS WILL CONTROL THE SURFACE WATER RUNOFF ON THE CAP, THEREFORE MINIMIZING EROSION.

POST CLOSURE CARE FOR THE CAP WILL CONTINUE FOR A MINIMUM OF 30 YEARS AFTER THE CLOSURE DATE AS OUTLINED IN OAC 3745-27-14. POST CLOSURE CARE INVOLVES LEACHATE COLLECTION AND MANAGEMENT, SURFACE WATER MANAGEMENT, GROUND WATER MONITORING, REGULAR INSPECTIONS OF THE CAP FOR EROSION, SUBSIDENCE, AND/OR SETTLEMENT, AND PERIODIC MAINTENANCE SUCH AS REPAIR OF ANY EROSION DAMAGE TO THE CAP OR ANY OF THE DRAINAGE CHANNELS FROM SURFACE WATER RUNOFF.

SURFACE LEACHATE SEEP AND GROUND WATER COLLECTION SYSTEM

A LEACHATE AND GROUND WATER COLLECTION SYSTEM WILL BE INSTALLED TO INTERCEPT ACID MINE DRAINAGE (AMD), LEACHATE AND GROUND WATER FROM THE LANDFILLED AREAS AND CHANNEL IT TO THE TREATMENT SYSTEM. THIS COLLECTION SYSTEM WILL PREVENT AMD AND LEACHATE FROM COLLECTING UNDER THE CAP AND DISCHARGING INTO KINGS RUN. THE COLLECTION SYSTEM IS ENVISIONED TO CONSIST OF COMBINED UNDERDRAINS AND FRENCH DRAINS THAT WILL BE INSTALLED AROUND THE SITE PERIMETER AND AT EXISTING AND NEWLY-IDENTIFIED LEACHATE SEEPS. SPECIFICS OF THE LEACHATE AND GROUND WATER COLLECTION SYSTEM REQUIREMENTS WILL BE DETERMINED DURING A PREDESIGN GROUND WATER STUDY OF THE SITE. THIS ADDITIONAL HYDROGEOLOGIC INVESTIGATION WILL ALSO BE NECESSARY TO PROVIDE FURTHER DATA ON

THE EXTENT OF GROUND-WATER CONTAMINATION AND TO DETERMINE THE POTENTIAL FOR CONTAMINATED GROUND WATER TO DISCHARGE BEYOND THE PROPOSED COLLECTION DRAIN.

TREATMENT OF COLLECTED WATERS WITH CONSTRUCTED WETLANDS

CONSTRUCTED WETLANDS ARE THE METHOD OF TREATING ACID MINE DRAINAGE AND LEACHATE PREFERRED BY U.S. EPA AND OEPA (SEE FIGURE 7) AT THE BRL SITE. WETLANDS ARE PREFERRED OVER CHEMICAL TREATMENT BECAUSE THEY REDUCE OPERATION AND MAINTENANCE (O&M) COSTS, WILL HAVE LESS IMPACT ON THE SURROUNDING AREA, AND HAVE PROVEN EFFECTIVE AT ACID MINE DRAINAGE RECLAMATION PROJECTS IN OHIO. THE GOALS OF THE TREATMENT SYSTEM ARE TO RAISE THE PH OF THE COLLECTED WATERS AND REDUCE THE LEVELS OF CONTAMINANTS OF CONCERN TO ACCEPTABLE LEVELS PRIOR TO DISCHARGE. INTERIUM DISCHARGE LIMITS AND A MONITORING PROGRAM FOR WATERS DISCHARGED FROM THE CONSTRUCTED WETLANDS TREATMENT SYSTEM ARE PRESENTED IN ATTACHMENT A. TREATABILITY STUDIES ARE UNDERWAY TO TEST HOW EFFECTIVELY THE WETLANDS WILL REMOVE CONTAMINANTS OF CONCERN AND TO OPTIMIZE THE PERFORMANCE OF THE SYSTEM. IF THE STUDIES CONCLUDE WETLANDS DO NOT ADEQUATELY REMOVE THE CHEMICALS, CONSTRUCTION OF THE CHEMICAL/PHYSICAL TREATMENT SYSTEM WILL BE REQUIRED.

THE SURFACE LEACHATE SEEP AND GROUND WATER COLLECTION SYSTEM WILL DISCHARGE INTO A RIPRAP-LINED (LIMESTONE) CHANNEL AT THE SOUTHERN END OF THE LANDFILL CAP FOR THE PURPOSE OF AERATING THE LEACHATE. THE LIMESTONE RIPRAP MAY ALSO ACT AS A PRETREATMENT TO NEUTRALIZE THE LEACHATE.

((MAP HERE))

THE RIPRAP LINED CHANNEL WILL THEN DISCHARGE TO A WETLAND WITH UP TO SIX, 3 ACRE PONDS, RESULTING IN A TOTAL SIZE UP TO 18 ACRES. EACH WETLAND WILL HAVE A ONE FOOT BASE OF COMPACTED CLAY OVERLAIN BY A GEOMEMBRANE TO MINIMIZE THE LOSS OF TREATMENT WATERS INTO THE UNDERLYING SOIL. THE GEOMEMBRANE LINER IS OVERLAIN BY SIX INCHES OF SAND, THEN ONE FOOT OF CRUSHED LIMESTONE AGGREGATE. THE LIMESTONE IS THEN COVERED WITH ONE FOOT OF SPENT MUSHROOM COMPOST, OR OTHER SUITABLE SUBSTRATE, WHICH IS SEEDED OR MULCHED TO ESTABLISH CATTAIL AND OTHER WETLAND VEGETATION GROWTH. THE CLEAN WATER RESULTING FROM THE CONSTRUCTED WETLANDS TREATMENT WILL BE DISCHARGED INTO LITTLE MCMAHON CREEK. TESTING OF LANDFILL LEACHATE WILL BE USED TO REFINE DESIGN SPECIFICS OF THE CONSTRUCTED WETLANDS. WETLAND CELLS MAY REQUIRE DREDGING IF SEDIMENTS AND/OR SLUDGE ACCUMULATES TO THE POINT THAT TREATMENT EFFECTIVENESS IS DECREASED. THE DREDGED MATERIALS SHALL BE TESTED TO DETERMINE THE PROPER METHOD OF DISPOSAL. ONCE A CELL HAS BEEN DREDGED, IT SHALL BE RECONSTRUCTED TO THE ORIGINAL SPECIFICATIONS.

MONITORING AND INSTITUTIONAL CONTROLS

OTHER COMPONENTS OF THE PREFERRED ALTERNATIVE INCLUDE MONITORING, FENCING AND POSSIBLE INSTITUTIONAL CONTROLS. GROUND WATER MONITORING WELLS WILL BE SAMPLED PERIODICALLY TO ASSURE THAT NO CONTAMINATION IS MOVING OFF OF THE SITE. IF EXCESS LEVELS OF CONTAMINANTS ARE IDENTIFIED, FUTURE ACTIONS MAY BE NECESSARY TO ADDRESS GROUND WATER PROBLEMS. SURFACE LEACHATE SEEPS WILL BE SAMPLED TO MONITOR CONTAMINANT LEVELS IN THE LANDFILL AND MONITORING KINGS RUN WILL DETECT ANY POSSIBLE DISCHARGES TO THAT STREAM. A FENCE WILL BE INSTALLED AROUND THE PERIMETER OF THE LANDFILL TO LIMIT TRESPASSING. INSTITUTIONAL CONTROLS LIMITING THE DEVELOPMENT OF THE PROPERTY AND THE PLACEMENT OF NEW WELLS ON THE PROPERTY AND ADJACENT TO THE SITE MAY BE SOUGHT VOLUNTARILY FROM OWNERS OR COMPELLED TO THE EXTENT AUTHORIZED UNDER ANY APPLICABLE LOCAL AND STATE LAWS. IN THE EVENT THAT INSTITUTIONAL CONTROLS ARE NOT IMPLEMENTED, THE SELECTED REMEDIAL ACTION WILL BE RE-EVALUATED TO DETERMINE IF ADDITIONAL ACTIONS SHOULD BE IMPLEMENTED TO ENSURE THAT THE REMEDY IS PERMANENT AND EFFECTIVE ON A LONG TERM BASIS.

TREATABILITY STUDY AND ADDITIONAL HYDROGEOLOGIC STUDY

THE FIRST PHASE OF TREATABILITY STUDY HAS BEGUN TO EVALUATE THE EFFECTIVENESS OF WETLANDS TREATMENT OF WATERS TYPICALLY EMANATING FROM THE **BUCKEYE RECLAMATION** LANDFILL SITE. THE FIRST PHASE INVOLVES A LABORATORY OR SCREENING SCALE STUDY IN WHICH LEACHATE COLLECTED FROM THE **BUCKEYE RECLAMATION** SITE IS INTRODUCED TO DIFFERENT COMBINATIONS OF SUBSTRATES UNDER BOTH AEROBIC AND ANAEROBIC CONDITIONS. ANALYSES OF THE LIQUID BOTH BEFORE AND AFTER TREATMENT, IN ADDITION TO MONITORING THE SAMPLES FOR HYDROGEN SULFIDE GENERATION AND COLOR CHANGES, WILL PROVIDE INFORMATION ON WHICH COMBINATION OF SUBSTRATES AND CONDITIONS ARE MORE EFFECTIVE. ONCE THE FIRST PHASE IS COMPLETE, LARGER SCALE STUDIES WILL BE REQUIRED DURING THE REMEDIAL DESIGN. THESE STUDIES MAY BE COMPRISED OF LONGER TERM LABORATORY TESTING AND/OR SMALL SCALE TEST SYSTEMS CONSTRUCTED ON THE **BUCKEYE RECLAMATION** LANDFILL SITE. IF TREATABILITY STUDIES INDICATE THAT THE WETLANDS WILL NOT EFFECTIVELY REMOVE CONTAMINANTS, CHEMICAL/ PHYSICAL TREATMENT WILL BE REQUIRED.

ADDITIONAL HYDROGEOLOGIC STUDIES WILL BE PERFORMED DURING THE REMEDIAL DESIGN OF THE SELECTED REMEDY. THE OBJECTIVE FOR THESE STUDIES IS TO REFINE DATA ON GROUND WATER FLOW DIRECTIONS IN WATER BEARING ZONES UNDER THE SITE, TO BETTER DEFINE LOCATIONS OF THE WATER TABLE, AND TO PROVIDE ADDITIONAL INFORMATION ON THE EXTENT OF SITE RELATED CONTAMINATION. THIS INFORMATION IS REQUIRED FOR PROPER DESIGN OF THE GROUND WATER AND SURFACE LEACHATE SEEP COLLECTION SYSTEM.

PERFORMANCE STANDARDS AND CLEAN-UP GOALS

PERFORMANCE STANDARDS FOR THE SOLID WASTE LANDFILL CAP ARE TAKEN FROM THE OHIO SOLID WASTE REGULATIONS (OAC-3745-27-11). PERMEABILITY OF THE LOW PERMEABILITY (CLAY) LAYER SHALL NOT EXCEED 1X10((-7))CENTIMETERS PER SECOND. PERMEABILITY OF THE DRAINAGE LAYER SHALL BE 1X10((-3))CENTIMETERS PER SECOND AT A MINIMUM. THICKNESSES OF THE CAP LAYERS SHALL MEET THE MINIMUM REQUIREMENTS SPECIFIED IN THE REGULATIONS. ALL SURFACE WATER MANAGEMENT STRUCTURES SHALL BE DESIGNED AND CONSTRUCTED TO MEET THE OHIO SOLID WASTE CLOSURE REQUIREMENTS.

DESIGN, CONSTRUCTION, AND OPERATION OF THE WETLANDS TREATMENT SYSTEM MUST MEET THE SUBSTANTIVE REQUIREMENTS OF APPROPRIATE OHIO PERMITS. CONTAMINANTS IN WATERS DISCHARGED FROM THE WETLANDS TREATMENT SYSTEM TO LITTLE MCMAHON CREEK SHALL NOT EXCEED THE INTERIM DISCHARGE LIMITS SHOWN IN ATTACHMENT A. MORE STRINGENT CONCENTRATION LIMITS MAY BE REQUIRED IF PROVEN ATTAINABLE DURING REMEDIAL DESIGN/REMEDIAL ACTION.

COST

THE APPROXIMATE COSTS OF THE SELECTED REMEDY ARE PROVIDED BELOW:

ESTIMATED CAPITAL COST:	$ 46,923,000
ESTIMATED PRESENT WORTH:	$ 48,663,000
ESTIMATED ANNUAL O&M COST:	$ 99,000

TIMEFRAME FOR IMPLEMENTATION

THE ESTIMATED AMOUNT OF TIME REQUIRED FOR CONSTRUCTION OF THIS REMEDY IS 18 MONTHS. THIS CONSTRUCTION SCHEDULE IS HEAVILY DEPENDENT ON WEATHER CONDITIONS AND CONSTRUCTION CONSIDERATIONS SUCH AS AVAILABILITY OF MATERIALS AND EQUIPMENT. NEGOTIATIONS FOR PERFORMANCE OF THE REMEDIAL DESIGN WILL REQUIRE FOUR MONTHS AND DESIGN WILL REQUIRE ONE YEAR AT A MINIMUM. THEREFORE, CONSTRUCTION OF THE REMEDY SHOULD BE COMPLETED APPROXIMATELY THREE YEARS AFTER THE RECORD OF DECISION IS SIGNED.

THE WETLANDS WILL NEED TO FUNCTION AS A LONG-TERM TREATMENT SYSTEM. VOLUMES OF COLLECTED LEACHATE AND GROUND WATER WILL DECREASE ONCE THE CAP IS IN PLACE, BUT THE TREATMENT PERIOD WILL LIKELY BE IN EXCESS OF 30 YEARS.

X. STATUTORY DETERMINATIONS

THE FOLLOWING IS A BRIEF DESCRIPTION OF HOW THE SELECTED REMEDY MEETS THE STATUTORY REQUIREMENTS OF SECTION 121 OF CERCLA.

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT.

THE ENDANGERMENT ASSESSMENT WHICH WAS DEVELOPED FOR THIS SITE CONCLUDED THAT THREE SIGNIFICANT EXPOSURE AND CONTAMINANT ROUTES EXIST FOR THE **BUCKEYE RECLAMATION** SITE. THESE ROUTES ARE:

* DERMAL CONTACT / INHALATION / INGESTION OF SURFACE SOILS
* MIGRATION OF CONTAMINANTS FROM SURFACE AND SUBSURFACE SOILS INTO GROUND WATER / SURFACE WATER
* *INGESTION OF CONTAMINATED GROUND WATER / SURFACE* WATER.

THE FOLLOWING MEDIA, THEREFORE PRESENT AN EXISTING OR POTENTIAL THREAT TO PUBLIC HEALTH AND THE ENVIRONMENT:

* SURFACE / SUBSURFACE SOILS
* GROUND WATER / SURFACE WATER

IMPLEMENTATION OF THE SELECTED REMEDY WILL REDUCE AND CONTROL POTENTIAL RISKS TO HUMAN HEALTH AND THE ENVIRONMENT POSED BY EXPOSURE TO THESE TWO MEDIA. CONTAMINATED SURFACE AND SUBSURFACE SOILS WILL BE COVERED BY THE LANDFILL CAP, THEREBY ELIMINATING THE DIRECT EXPOSURE ROUTE. INSTITUTIONAL CONTROLS THAT MAY BE PLACED ON THE PROPERTY WILL SPECIFY FUTURE USE LIMITATIONS FOR THE SITE AREA. CONTAMINATED DISCHARGES FROM THE LANDFILL WILL BE INTERCEPTED BY THE SURFACE LEACHATE SEEP AND GROUND WATER COLLECTION SYSTEM, THUS IMPROVING THE LOCAL SURFACE WATER QUALITY. RISKS PRESENTED BY THE GROUND WATER AND SURFACE WATERS WILL BE REDUCED BY TREATING THE WATERS IN THE CONSTRUCTED WETLANDS. SURFACE AND GROUND WATER CLEAN-UP LEVELS FOR THE TREATMENT SYSTEM ARE LISTED IN ATTACHMENT A. ONCE REMEDIAL ACTION IS UNDERWAY, ANY RISK POSED BY THE SITE WILL FALL WITHIN THE CUMULATIVE RISK RANGE OF 10((-4)) TO 10((-7)) FOR CARCINOGENIC COMPOUNDS AND SO THAT THE CUMULATIVE HAZARD INDICES FOR NONCARCINOGENS WILL BE LESS THAN ONE. IMPLEMENTATION OF THE SELECTED REMEDY WILL NOT POSE UNACCEPTABLE SHORT-TERM RISKS OR CROSS-MEDIA IMPACTS.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS.

THE SELECTED REMEDY IS DESIGNED TO MEET ALL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) OF FEDERAL AND STATE STATUTES IN ACCORDANCE WITH SECTION 121(D) OF CERCLA, EXCEPT WHERE IT WILL BE NECESSARY TO OBTAIN WAIVERS. CERCLA SECTION 121(D) ALLOWS FOR SELECTION OF A REMEDY THAT DOES NOT ATTAIN ARARS UNDER LIMITED CIRCUMSTANCES. THE WAIVER OF THE RCRA CLOSURE STANDARD ARAR AT THE **BUCKEYE RECLAMATION** LANDFILL SITE IS JUSTIFIED BECAUSE 'COMPLIANCE WITH SUCH REQUIREMENTS IS

TECHNICALLY IMPRACTICABLE FROM AN ENGINEERING PERSPECTIVE' AND 'THE REMEDIAL ACTION SELECTED WILL ATTAIN A STANDARD OF PERFORMANCE THAT IS EQUIVALENT TO THAT REQUIRED UNDER THE OTHERWISE APPLICABLE STANDARD, REQUIREMENT, CRITERIA, OR LIMITATION, THROUGH USE OF ANOTHER METHOD OR APPROACH'.

THE FEDERAL ARARS INCLUDE RCRA (40 CFR PART 260-271), THE SAFE DRINKING WATER ACT (40 CFR SECTION 141.11 AND .12), THE CLEAN WATER ACT (40 CFR PARTS 122, 125 AND 131), AND THE CLEAN AIR ACT (40 CFR PARTS 50, 60 AND 61). STATE ARARS INCLUDE THE OHIO REVISED CODE CHAPTER 6111 AND 3734.

THE FOLLOWING SPECIFIC ARARS WILL BE MET BY THE SELECTED REMEDY:

SURFACE WATER

SUBSTANTIVE REQUIREMENTS OF OHIO REVISED CODE (ORC) CHAPTER 6111, THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) AND SECTION 402 OF THE CLEAN WATER ACT (CWA) WILL BE MET BY THE WETLANDS TREATMENT SYSTEM. THE DISCHARGE LIMITS FOR TREATED GROUND WATER AND LANDFILL LEACHATE DISCHARGED TO LITTLE MCMAHON CREEK ARE LISTED IN ATTACHMENT A. THE LIMITS MAY BE MODIFIED TO MORE STRINGENT LEVELS IF PROVEN FEASIBLE DURING THE REMEDIAL DESIGN/REMEDIAL ACTION PROCESS. OHIO REVISED CODE (ORC) 6111 ESTABLISHES OHIO EPA'S AUTHORITY TO SET WATER QUALITY STANDARDS (SECTION 6111.04) AND REGULATE WATER POLLUTION SOURCES. THE RULES DEVELOPED AND IMPLEMENTED BY OHIO EPA BASED ON CHAPTER 6111 ORC ARE CONTAINED IN OAC SECTION 3745-1-03 THROUGH 3745-1-07 INCLUSIVE, 3745-01-13, 3745-31-05, 3745-32-05, AND 3745-33-05.

SOIL

RCRA LAND DISPOSAL RESTRICTIONS (40 CFR PART 268)
THE SELECTED REMEDY INVOLVES CAPPING WASTES LOCATED ON SITE, THEREFORE OFF-SITE DISPOSAL WILL NOT OCCUR AS PART OF THE SELECTED REMEDY. CONSEQUENTLY, THE RCRA LDRS WILL NOT BE TRIGGERED.

SOLID WASTE CLOSURE REQUIREMENTS

ORC CHAPTER 3734 ESTABLISHES OHIO EPA'S AUTHORITY TO REGULATE CLOSURE OF SOLID WASTE LANDFILLS. PURSUANT TO THAT STATUTE, OAC 3745-27-11, 3745-27-10, AND 3745-27-14 DESCRIBE THE SPECIFIC REQUIREMENTS FOR FINAL CLOSURE, GROUND WATER MONITORING PROGRAMS, AND POST-CLOSURE CARE OF SANITARY LANDFILL FACILITIES, RESPECTIVELY.

COST-EFFECTIVENESS.

AN ANALYSIS OF COST EFFECTIVENESS OF THE SELECTED REMEDY

INDICATES THAT THE REMEDY CHOSEN IS COST EFFECTIVE. WHILE THE OVERALL COST OF THE REMEDY IS HIGH, IT IS MUCH LESS COSTLY THAN AND IS AS PROTECTIVE AS A RCRA CAP. THE WETLANDS INNOVATIVE TREATMENT TECHNOLOGY FOR COLLECTED LEACHATE AND GROUND WATER SHOULD PROVIDE EFFECTIVE TREATMENT AT LOWER CAPITAL AND OPERATION AND MAINTENANCE COSTS, INCREASING THE COST-EFFECTIVENESS OF THE REMEDY.

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT (OR RESOURCE RECOVERY) TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE (MEP).

THE U.S. EPA BELIEVES THAT THE SELECTED REMEDY REPRESENTS THE MAXIMUM EXTENT WHICH PERMANENT SOLUTIONS AND TREATMENT TECHNOLOGIES CAN BE UTILIZED IN A COST-EFFECTIVE MANNER FOR THE FINAL REMEDY AT THE **BUCKEYE RECLAMATION** LANDFILL SITE. OF THE ALTERNATIVES THAT ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND COMPLY WITH ARARS, U.S. EPA HAS DETERMINED THAT THE SELECTED REMEDY PROVIDES THE BEST BALANCE OF TRADEOFFS WHEN CONSIDERING LONG-TERM EFFECTIVENESS AND PERMANENCE, REDUCTION IN OXICITY, MOBILITY OR VOLUME ACHIEVED THROUGH TREATMENT, SHORTTERM EFFECTIVENESS, IMPLEMENTABILITY, THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT AND CONSIDERING THE STATE AND COMMUNITY ACCEPTANCE.

THE TWO CAPPING ALTERNATIVES WHICH WERE EVALUATED ARE CONSIDERED TO BE EQUAL IN TERMS OF LONG-TERM EFFECTIVENESS AND PERMANENCE. THE TWO LEACHATE AND GROUND WATER TREATMENT OPTIONS WERE CONSIDERED EQUAL IN TERMS OF REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT, ALTHOUGH THE WETLANDS TREATMENT IS AN INNOVATIVE TECHNOLOGY AND IS LESS PROVEN. THE SOLID WASTE LANDFILL CAP WAS CONSIDERED SUPERIOR TO THE RCRA CAP IN TERMS OF; 1) SHORT-TERM EFFECTIVENESS BECAUSE IT MAY BE CONSTRUCTED MORE QUICKLY; 2) IMPLEMENTABILITY BECAUSE IT REQUIRES FAR LESS EARTH MOVING ACTIVITIES AND DOES NOT REQUIRE PIPING OF KINGS RUN UNDER THE CAP AND; 3) THE SOLID WASTE CAP WITH THE WETLAND TREATMENT OPTION IS APPROXIMATELY $150,000,000 LESS COSTLY THAN THE RCRA CAP WITH SIMILAR TREATMENT.

PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT.

THREATS FROM EXPOSURE TO SURFACE AND GROUND WATER AT THIS SITE SHALL BE ADDRESSED THROUGH TREATMENT IN THE CONSTRUCTED WETLANDS. THE TREATMENT SYSTEM WILL REMOVE CONTAMINANTS OF CONCERN FROM COLLECTED WATERS AND CONVERT THEM INTO MORE STABLE FORMS. BECAUSE THE ON-SITE SOILS CONTAIN LOW LEVELS OF CONTAMINATION OVER A LARGE AREA, TREATMENT IS NOT A PRACTICABLE SOLUTION FOR THREATS POSED BY THEM. FOR THIS REASON, A CONTAINMENT OPTION WAS SELECTED OVER A TREATMENT OPTION.

XI. ADDITIONAL STUDIES

SECTION 311 OF CERCLA, 42 U.S.C. SECTION 9660, PROVIDES THAT U.S. EPA SHALL CONDUCT 'RESEARCH EVALUATION, TESTING, DEVELOPMENT, AND DEMONSTRATION OF ALTERNATIVE OR INNOVATIVE TREATMENT TECHNOLOGIES WHICH MAY BE UTILIZED IN RESPONSE ACTIONS TO ACHIEVE MORE PERMANENT PROTECTION OF HUMAN HEALTH AND WELFARE AND THE ENVIRONMENT.

WETLANDS TREATMENT OF THE COLLECTED LEACHATE AND GROUND WATER IS AN INNOVATIVE TECHNOLOGY WHICH INVOLVES UTILIZING INDIGENOUS OR INTRODUCED MICROFLORA TO RAISE PH OF THE WATERS AND CATALYZE SULFATE REDUCING REACTIONS. THE LEACHATE HAS A HIGH CONCENTRATION OF SULFATE, THEREFORE GENERATION OF SULFIDE IN AN ANAEROBIC ENVIRONMENT IS ASSURED. UNDER THESE CONDITIONS, IRON SULFIDE PRECIPITATION SHOULD ALSO REMOVE ARSENIC AS AN ARSENIDE. WITH THE RISE IN PH TO ABOVE 6, ALUMINUM HYDROXIDE WILL PRECIPITATE AND THIS WILL ALSO POSITIVELY AFFECT THE REMOVAL OF BERYLLIUM EITHER AS AN HYDROXIDE OR AN ADSORBED SPECIES.

A BENCH-SCALE OR SCREENING-SCALE TREATABILITY STUDY IS CURRENTLY IN PROGRESS. INFORMATION GAINED FROM THIS STUDY WILL BE USED TO SCOPE LARGER-SCALE, LONGER TERM STUDIES TO BE CONDUCTED DURING THE REMEDIAL DESIGN. IF THE WETLANDS DO NOT PROVE EFFECTIVE IN REMOVING CONTAMINANTS, CHEMICAL/PHYSICAL TREATMENT WILL BE USED.

ADDITIONAL HYDROGEOLOGIC STUDIES WILL BE PERFORMED DURING THE REMEDIAL DESIGN OF THE SELECTED REMEDY. THE OBJECTIVE FOR THESE STUDIES IS TO REFINE DATA ON GROUND WATER FLOW DIRECTIONS IN WATER BEARING ZONES UNDER THE SITE, TO BETTER DEFINE LOCATIONS OF THE WATER TABLE, AND TO PROVIDE ADDITIONAL INFORMATION ON THE EXTENT OF SITE RELATED CONTAMINATION. THIS INFORMATION IS REQUIRED FOR PROPER DESIGN OF THE GROUND WATER AND SURFACE LEACHATE SEEP COLLECTION SYSTEM.

XII. DOCUMENTATION OF SIGNIFICANT CHANGES

THE SELECTED ALTERNATIVE IS IDENTICAL TO THE PREFERRED ALTERNATIVE AS DESCRIBED IN THE PROPOSED PLAN. IF THE WETLANDS TREATMENT SYSTEM PROVES INEFFECTIVE DURING THE TREATABILITY STUDIES IN REMOVING CONTAMINANTS OF CONCERN, THE RECORD OF DECISION WILL BE MODIFIED WITH AN EXPLANATION OF SIGNIFICANT DIFFERENCES (ESD) TO SELECT CHEMICAL/PHYSICAL TREATMENT FOR THE COLLECTED LEACHATE AND GROUND WATER.

TABLE 1.
AVERAGE AND MAXIMUM CONTAMINANT CONCENTRATIONS
AT **BUCKEYE RECLAMATION** LANDFILL

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

TABLE 2.
TOXICITY FACTORS FOR QUANTIFICATION OF CHRONIC AND LIFETIME HAZARDS FOR INDICATOR CHEMICALS AT THE BRL SITE

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

TABLE 4. SUMMARY OF NONCANCER HAZARD/CANCER RISK CALCULATIONS FOR ENVIRONMENTAL MEDIA AT THE BRL SITE FOR POTENTIAL ON-SITE PATHWAYS: RESIDENTIAL LIVING ON-SITE IN A FUTURE DEVELOPMENT

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

TABLE 5. SUMMARY OF TOTAL SITE RISK (EXISTING AND POTENTIAL EXPOSURE PATHWAYS) FOR CHEMICAL CONTAMINANTS AT THE BRL SITE

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

TABLE 6. BENTHIC INVERTEBRATE TAXA COLLECTED FROM ARTIFICIAL SUBSTRATE SAMPLERS DEPLOYED AT 8 STATIONS IN AND NEAR THE **BUCKEYE RECLAMATION** LANDFILL, BELMONT COUNTY, OHIO, DURING JUNE 26 - AUGUST 6, 1987

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

AUTHORIZATION TO DISCHARGE TO LITTLE MCMAHON CREEK
IN COMPLIANCE WITH THE PROVISIONS OF THE FEDERAL WATER POLLUTION CONTROL ACT, AS AMENDED (33 U.S.C. 1251 ET. SEQ.) AND THE OHIO WATER POLLUTION CONTROL ACT (OHIO REVISED CODE SECTION 6111),

BUCKEYE RECLAMATION LANDFILL IS AUTHORIZED BY THE OHIO ENVIRONMENTAL PROTECTION AGENCY, HEREAFTER REFERRED TO AS 'OHIO EPA', TO DISCHARGE FROM THE TREATMENT SYSTEM LOCATED APPROXIMATELY MILES SOUTH OF ST. CLAIRSVILLE, OHIO IN BELMONT COUNTY IN ACCORDANCE WITH THE CONDITIONS SPECIFIED BELOW:

A.1. FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS FOR THE **BUCKEYE RECLAMATION** LANDFILL

BUCKEYE RECLAMATION LANDFILL (THE ENTITY) IS AUTHORIZED TO DISCHARGE IN ACCORDANCE WITH THE FOLLOWING LIMITATIONS AND MONITORING REQUIREMENTS FROM THE WASTEWATER TREATMENT WORKS, BEGINNING ON THE FIRST DAY OF AUTHORIZED DISCHARGE AND LASTING UNTIL 44 MONTHS FROM THE DATE THE TWELFTH BIOASSAY IS COMPLETED (IN ACCORDANCE WITH THE PROVISIONS CONTAINED IN PARAGRAPH C, BELOW):

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

A.2. FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS FOR THE **BUCKEYE RECLAMATION** LANDFILL

BUCKEYE RECLAMATION LANDFILL IS AUTHORIZED TO DISCHARGE IN ACCORDANCE WITH THE FOLLOWING LIMITATIONS AND MONITORING REQUIREMENTS FROM THE WASTEWATER TREATMENT WORKS, BEGINNING 44 MONTHS FROM THE DATE THE TWELFTH MONTHLY BIOSSAY IS COMPLETED (IN ACCORDANCE UNTIL THE TREATMENT WORLS ARE NO LONGER IN SERVICE AND THERE IS NO DISCHARGE FROM THE FACILITY OR UNTIL THESE REQUIREMENTS ARE MODIFIED:

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE

B.2. THE PH (REPORTING CODE 00400) SHALL NOT BE LESS THAN 6.5 S.U. NOR GREATER THAN 9.0 S.U. AND SHALL BE MONITORED 2/WEEK BY GRAB SAMPLE.

C. BIOMONITORING REQUIREMENTS FOR **BUCKEYE RECLAMATION** LANDFILL

AS SOON AS POSSIBLE, BUT NOT LATER THAN THREE MONTHS AFTER TREATMENT HAS BEEN INSTALLED TO MEET FINAL CHEMICAL-SPECIFIC LIMITS, THE ENTITY SHALL INITIATE AN EFFLUENT BIOMONITORING PROGRAM TO DETERMINE THE TOXICITY OF EFFLUENT FROM **BUCKEYE RECLAMATION** LANDFILL.

TESTING REQUIREMENTS:

1. ACUTE BIOASSAYS:

THE ENTITY SHALL CONDUCT MONTHLY 48-HOUR ACUTE BIOASSAYS USING CERIODAPHNIA AND 96-HOUR ACUTE BIOASSAYS USING THE FATHEAD MINNOW (PIMEPHALES PROMELAS) FOR A PERIOD OF ONE YEAR. IF DISCHARGES ARE INTERMITTENT AND DO NOT OCCUR ON A MONTHLY BASIS, THEN 12 ACUTE BIOASSAYS SHALL BE COMPLETED WITH NO MORE THAN 1 BIOASSAY OCCURRING PER EVERY FOUR WEEKS PER CALENDAR MONTH. THE TESTS SHALL BE CONDUCTED USING 24-HOUR COMPOSITE SAMPLES OF FINAL EFFLUENT FROM OUTFALL 001. IN ADDITION, AN INSTREAM GRAB SAMPLE WILL BE TESTED TO DETERMINE NEAR FIELD TOXICITY. SEE ITEM 4 UNDER TESTING PROTOCOL FOR SPECIFICS ON SAMPLING LOCALES.

2. CHEMICAL ANALYSIS:

A SUFFICIENT VOLUME OF EFFLUENT SHALL BE COLLECTED TO ALLOW FOR CHEMICAL ANALYSIS. BIOASSAY EFFLUENT SAMPLING MAY BE COORDINATED WITH OTHER SAMPLING REQUIREMENTS AS APPROPRIATE TO AVOID DUPLICATION. THE ANALYSES DETAILED IN THE FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS TABLES SHOULD BE CONDUCTED FOR THE EFFLUENT SAMPLE. IN ADDITION, ALKALINITY AND HARDNESS (AS CACO3) SHOULD ALSO BE MEASURED. CHEMICAL ANALYSIS MUST COMPLY WITH OHIO EPA ACCEPTED PROCEDURES.

TESTING PROTOCOL:

1. THE TEST SHALL BE CONDUCTED USING PROCEDURES CONTAINED IN THE OHIO EPA QUALITY ASSURANCE MANUAL (OR CURRENT REVISIONS). ANY REQUEST TO USE A DIFFERENT METHODOLOGY MUST BE APPROVED BY THE OEPA PRIOR TO THE INITIATION OF TESTING.

2. THE ENTITY SHALL DETERMINE A MEDIAN LETHAL CONCENTRATION (LC50) AND/OR MEDIAN EFFECTIVE CONCENTRATION (EC50) FOR ACUTE EFFECTS.

3. A MINIMUM OF 5 EFFLUENT CONCENTRATIONS (E.G., 100, 56, 32, 18, AND 10 PERCENT BY VOLUME EFFLUENT) SHALL BE USED IN EACH EFFLUENT BIOASSAY. DILUTION AND CONTROL WATER SHALL BE COLLECTED AS A GRAB SAMPLE AT STATION 801 (A SITE UPSTREAM FROM THE OUTFALL OUTSIDE THE ZONE OF EFFLUENT AND RECEIVING WATER INTERACTION). RECONSTITUTED WATER, REARING UNIT WATER (WATER IN WHICH THE TEST ORGANISMS WERE REARED) OR OTHER HIGH QUALITY WATER SHALL BE USED AS A SECOND CONTROL WATER. IF THE PRIMARY CONTROL AND DILUTION WATER FROM STATION 801 IS DEMONSTRATED TO CONTAIN UNACCEPTABLE TOXICITY IN A TEST, THEN THE SECONDARY CONTROL SHALL BE USED AS THE DILUENT IN SUCCEEDING TESTS UNTIL WATER FROM STATION 801 IS SHOWN TO BE ACCEPTABLE FOR USE AS A DILUENT IN THREE SUCCESSIVE BIOASSAYS WHERE IT HAS BEEN TESTED AT FULL-STRENGTH (I.E., NO DILUTIONS). AN ACUTE TEST SHALL BE REPEATED IF MORTALITY, OR COMBINATION OF MORTALITY PLUS OTHER ADVERSE EFFECTS, EXCEEDS TEN PERCENT OF ONE OF THE SPECIES OF TEST ORGANISMS IN BOTH CONTROL WATERS (PRIMARY AND SECONDARY).

4. TESTING OF AMBIENT WATER SHALL BE CONDUCTED AS FOLLOWS. IN CONJUNCTION WITH THE ACUTE TESTS OF THE EFFLUENT, AN INSTREAM GRAB SAMPLE SHALL BE COLLECTED AT STATION 901 (A POINT LOCATED WITHIN THE EFFLUENT PLUME 3 METERS (10 FEET) DOWNSTREAM FROM OUTFALL 001). THE LOCATION OF THE EFFLUENT PLUME SHOULD BE CONFIRMED AT THE TIME OF SAMPLING USING TEMPERATURE MEASUREMENTS, CONDUCTIVITY MEASUREMENTS OR A DYE STUDY. BIOASSAYS OF THESE INSTREAM SAMPLES WILL DETERMINE IF NEAR FIELD TOXICITY IS OCCURRING.

RESPONSIVENESS SUMMARY FOR THE RECORD OF DECISION

I. OVERVIEW

PUBLIC REACTION TO THE PROPOSED PLAN WAS MIXED. A NUMBER OF CITIZENS EXPRESSED CONCERN OVER THE HIGH COST OF THE PROPOSED REMEDY. SOME WERE DOUBTFUL THAT HEALTH RISKS AT THE SITE HAD BEEN CHARACTERIZED ACCURATELY AND THAT THE EXPENSIVE REMEDY WAS JUSTIFIED DUE TO THE AGENCIES' RISK ESTIMATES. COMMENTS SUPPORTING THE PROPOSED ALTERNATIVE WERE ALSO SUBMITTED BY THE PUBLIC. THE POTENTIALLY RESPONSIBLE PARTY (PRP) GROUP SUBMITTED COMMENTS REGARDING SEVERAL OF THE AGENCIES' ASSUMPTIONS AND CONCLUSIONS IN THE REMEDIAL INVESTIGATION AND ENDANGERMENT ASSESSMENT.

II. BACKGROUND ON COMMUNITY INVOLVEMENT

THE FOLLOWING ARE THE COMMUNITY RELATIONS ACTIVITIES CONDUCTED AT THE **BUCKEYE RECLAMATION** LANDFILL SUPERFUND SITE (BRL SITE) FROM THE COMPLETION OF THE FEASIBILITY STUDY TO THE END OF THE PUBLIC COMMENT PERIOD.

1. U.S. EPA AND OHIO EPA PREPARED A PROPOSED PLAN IN MAY 1991 FOR RELEASE TO THE PUBLIC AT THE BEGINNING OF THE PUBLIC COMMENT PERIOD. A FACT SHEET, WHICH SUMMARIZED THE PROPOSED PLAN, WAS ALSO DISTRIBUTED TO INDIVIDUALS ON THE MAILING LIST. THE ADMINISTRATIVE RECORD WAS PLACED IN LOCAL INFORMATION REPOSITORIES AT THE ST. CLAIRSVILLE PUBLIC LIBRARY AND THE NEFFS BRANCH OF THE MARTINS FERRY PUBLIC LIBRARY.

2. U.S. EPA PLACED PUBLIC NOTICES ON MAY 13, 1991 IN LOCAL NEWSPAPERS INCLUDING THE INTELLINGENCER, WHEELING, WEST VIRGINIA AND THE TIMES - LEADER, MARTINS FERRY, OHIO TO ANNOUNCE THE BEGINNING OF THE PUBLIC COMMENT PERIOD. THE NOTICE ALSO ANNOUNCED A PUBLIC MEETING WHICH WAS HELD ON MAY 30, 1991.

3. U.S. EPA AND OHIO EPA CONDUCTED A PUBLIC MEETING ON MAY 30, 1991, TO EXPLAIN THE DETAILS OF THE REMEDIAL INVESTIGATION /FEASIBILITY STUDY AND PROPOSED PLAN, TO ANSWER QUESTIONS FROM INTERESTED MEMBERS OF THE COMMUNITY, AND TO ACCEPT PUBLIC COMMENTS FROM THE COMMUNITY. A COURT REPORTER WAS PRESENT TO RECORD THE MEETING. U.S. EPA DISTRIBUTED THE PROPOSED PLAN FACT SHEET AT THE MEETING.

4. A REQUEST FOR A 10 DAY EXTENSION TO THE PUBLIC COMMENT PERIOD WAS MADE ON MAY 31, 1991. U.S. EPA GRANTED THE EXTENSION, WHICH RAN UNTIL JUNE 26, 1991.

5. U.S. EPA PLACED A PUBLIC NOTICE IN THE INTELLIGENCER AND THE TIMES - LEADER ANNOUNCING THE EXTENSION TO THE PUBLIC COMMENT PERIOD.

III. SUMMARY OF PUBLIC COMMENTS AND LEAD AGENCY RESPONSE

COMMENTS 1 THROUGH 16 WERE RAISED IN ORAL COMMENTS AT THE PUBLIC MEETING AND IN WRITTEN COMMENTS:

1. COMMENT

THE SITUATION AT THE LANDFILL COULD HAVE BEEN AVOIDED IN 1987 BECAUSE THE AGENCIES KNEW OF THE GOB (COAL MINE SPOIL) PILE, CREEKS AND RUNOFF.

RESPONSE

U.S. EPA WAS AWARE OF POTENTIAL PROBLEMS AT THE **BUCKEYE RECLAMATION** LANDFILL SITE IN 1987. THE SITE HAD BEEN PLACED ON THE SUPERFUND NATIONAL PRIORITIES LIST ON SEPTEMBER 8, 1983. HOWEVER, THE AGENCIES DID NOT HAVE ENOUGH ENVIRONMENTAL DATA TO CHARACTERIZE THE SITE AND SELECT AN APPROPRIATE REMEDY UNTIL THE END OF THE REMEDIAL INVESTIGATION.

2. COMMENT

LANDFILLS SHOULD BE DONE AWAY WITH AS MUCH AS POSSIBLE. RECYCLING IS THE ANSWER TO THE GARBAGE AND HAZARDOUS WASTE PROBLEM.

RESPONSE

THE AGENCY AGREES AND SUPPORTS ALL RECYCLING EFFORTS. HOWEVER, LANDFILLS WILL BE NECESSARY FOR AT LEAST THE FORESEEABLE FUTURE OR UNTIL CONSUMER PRODUCT MANUFACTURING AND DISPOSAL TRENDS CHANGE.

3. COMMENT

WITH FORTY-EIGHT MILLION THE AGENCIES COULD BUILD AN INCINERATOR ON THE SITE.

RESPONSE

INCINERATION OF ON-SITE SOILS WAS CONSIDERED IN THE EARLIER PHASES OF THE FEASIBILITY STUDY. IT WAS ELIMINATED AS A TREATMENT OPTION BECAUSE IT IS MORE EFFECTIVE FOR VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS. FURTHER TREATMENT AND/OR DISPOSAL WOULD BE REQUIRED FOR THE RESIDUAL ASH WHICH WOULD CONTAIN ELEVATED METAL CONCENTRATIONS. INCINERATION WOULD BE DIFFICULT TO IMPLEMENT AND CAPITAL AND OPERATION & MAINTENANCE COSTS WOULD BE HIGH. COSTS WOULD BE FURTHER INCREASED DUE TO THE TREATMENT AND/OR DISPOSAL COSTS FOR THE RESIDUE ASH. ADDITIONAL COSTS TO THE OVERALL REMEDY ASSOCIATED WITH INCINERATION OF THE WASTE PIT SOILS MAY HAVE BEEN AS MUCH AS 20 MILLION.

4. COMMENT

CLOSING OF OLD LANDFILLS LEADS TO THE REQUIREMENT THAT NEW LANDFILLS BE CONSTRUCTED FOR GARBAGE DISPOSAL IN THE SAME LOCALITY. UNDER RECENTLY PASSED LEGISLATION, IT COSTS APPROXIMATELY TEN MILLION DOLLARS TO ESTABLISH NEW LANDFILLS.

THE COST TO DUMP IN NEW LANDFILLS WILL INCREASE GREATLY. MORE PEOPLE WILL ILLEGALLY DUMP RATHER THAN PAY INCREASED FEES. THUSLY, NEW LAWS AIMED AT PROTECTING THE ENVIRONMENT LEAD TO DEGRATION OF IT.

RESPONSE

THE AGENCY DISAGREES WITH THIS COMMENT. EXAMPLES WHICH ILLUSTRATE PROGRESS TOWARD MAKING THE ENVIRONMENT SAFER AND CLEANER ARE EVIDENT THROUGHOUT THE NATION'S LAND, AIR AND WATER. MUCH OF THIS PROGRESS IS THE DIRECT RESULT OF LAWS PASSED BY CONGRESS TO PROTECT THE ENVIRONMENT AND AN INCREASED PUBLIC AWARENESS OF THE BENEFITS OF A CLEAN ENVIRONMENT. THE ECONOMIC COSTS SEEM HIGH BECAUSE THEY WERE LARGELY IGNORED IN THE PAST. AS THE NATIONS ECONOMY SWITCHES TOWARD THE INCLUSION OF ENVIRONMENTAL COST AS A COST OF DOING BUSINESS, THE DOLLARS SPENT ON DISPOSAL AND WASTE WILL ACTUALLY DROP.

5. COMMENT

THE GOB (COAL MINE REFUSE) THAT IS EXPOSED AT THE BOTTOM OF THE LANDFILL SHOWS HIGH CLAY CONTENT -- A PERFECT SEALER FOR A LANDFILL. IN ESSENCE, THE LOCATION OF THIS SITE AND COMPOSITION IS PERFECT FOR A LANDFILL.

RESPONSE

THE COAL MINE REFUSE MAY HAVE A HIGH CLAY CONTENT, BUT IT ALSO CONTAINS A LARGE FRACTION OF COARSE GRAINED PARTICLES, WHICH INCREASE THE PERMEABILITY OF THE MATERIAL. IF THE COAL MINE REFUSE WAS A PERFECT SEALER, THERE SHOULD BE NO LEACHATE DISCHARGES FROM THE SITE, HOWEVER, THIS IS OBVIOUSLY HAPPENING. GROUND WATER MONITORING DATA HAS ALSO DEMONSTRATED THAT CONTAMINANTS FOUND IN THE WASTE PIT HAVE MIGRATED OUT OF IT AND MOVED DOWNGRADIENT. IN SUMMARY, THE MATERIALS AND LOCATION OF THIS LANDFILL ARE REALLY NO DIFFERENT FROM ANY LANDFILL WHICH IS NOT AN ENGINEERED STRUCTURE. THERE ARE PROBLEMS WITH THE **BUCKEYE RECLAMATION** LANDFILL WHICH THE STUDIES HAVE IDENTIFIED AND THE AGENCY INTENDS TO ADDRESS.

6. COMMENT

WHAT'S THE BIG DANGER THAT EPA HAS FOUND WITH THIS LANDFILL? A NUMBER OF CONTAMINANTS SUCH AS BENZENE, ARSENIC, AND CHROMIUM WHICH EXCEED FEDERAL SAFE DRINKING WATER STANDARDS -- BUT NO ONE IS DRINKING THE WATER FROM THE SITE! YOUR REPORT STATES THAT 'CONCENTRATIONS OF GROUND WATER CONTAMINANTS DECREASED BELOW DETECTION LIMITS BEFORE MOVING

BEYOND SITE BOUNDARIES.' (I.E. THIS MEAN NO CONTAMINATION FROM THOSE PREVIOUSLY MENTIONED ARE MOVING OFF-SITE.)

RESPONSE

THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA) MANDATES THAT THE AGENCY IMPLEMENT REMEDIES WHICH ENSURE LONG-TERM PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT UTILIZING INSTITUTIONAL CONTROLS ONLY WHEN NO OTHER REMEDY WILL WORK. THE PRESENCE OF THE CONTAMINANTS MENTIONED ABOVE IN THE ON-SITE GROUND WATER INDICATES A POTENTIAL FOR FURTHER FUTURE RELEASES. THE AGENCY CAN NOT RELY ON HAPPEN STANCE AND LUCK TO ASSURE THE CONTAMINATION STAYS PUT. **BUCKEYE RECLAMATION** LANDFILL IS A FAIRLY YOUNG LANDFILL. ITS PEAK GAS AND LEACHATE PRODUCTION PROBABLY WON'T OCCUR FOR TEN YEARS OR MORE. THE AGENCY, THEREFORE, MUST TAKE MEASURES NOW TO PREVENT OFF-SITE MIGRATION OF THE CONTAMINANTS BEFORE THE CURRENT SITUATION BECOMES WORSE.

7. COMMENT

'SURFACE WATER SAMPLES COLLECTED FORM NEARBY CREEKS AND LEACHATE SEEPS DETECTED CONTAMINATION FROM BOTH ACID MINE DRAINAGE AND THE LANDFILL. THIS TYPE OF LEACHATE CAN BE NEUTRALIZED AND TREATED BY THE USE OF CRUSHED LIMESTONE AND THE CONSTRUCTION OF WETLANDS OR BOGS UTILIZING CATTAILS.

RESPONSE

THE AGENCY AGREES THAT THIS TYPE OF LEACHATE CAN BE TREATED WITH CONSTRUCTED WETLANDS. HOWEVER, THE AGENCY WOULD LIKE TO STRESS THAT FOR THIS SYSTEM TO PERFORM EFFECTIVELY AND RELIABLY, IT MUST BE CAREFULLY EVALUATED AND DESIGNED. THE TREATMENT SYSTEM MUST COMPLY WITH REGULATIONS WHICH ESTABLISH DISCHARGE LIMITS FOR THE TREATED WATER. BECAUSE OF THIS, TREATING THE LEACHATE IS NOT AS EASY AS LINING THE CREEKS WITH LIMESTONE AND PLANTING CATTAILS.

8. COMMENT

THERE IS MENTION OF AN 'INDUSTRIAL WASTE PIT' IN WHICH HIGH LEVELS OF CONTAMINATION WERE FOUND. THIS PIT IS ONLY APPROXIMATELY ONE HALF ACRE IN SIZE AND NEARLY IN THE MIDDLE OF THE LANDFILL, AND IT IS COVERED WITH TOP SOIL AND GROWING GRASSES. THREE OF THE TWENTY-FOUR MONITORING WELLS DRILLED ARE FOUND ONLY 40 YARDS AND BELOW THIS PIT, AND IT'S MY UNDERSTANDING THAT THESE WELLS SHOW NO MIGRATION OF THE CONTAMINANTS FROM THE PIT. ONE MUST ASSUME THAT THE INDUSTRIAL WASTE IS STAYING RIGHT WHERE IT WAS PUT.

RESPONSE

MONITORING DATA COLLECTED DURING THE REMEDIAL INVESTIGATION DOES NOT SUPPORT THIS STATEMENT. RELATIVELY HIGH LEVELS OF THREE VOLATILE ORGANIC COMPOUNDS (VOCS), WHICH WERE IDENTIFIED AS CHEMICALS OF CONCERN AND DETECTED IN THE WASTE PIT, WERE DETECTED IN MONITORING WELL MW-4A. THIS WELL IS LOCATED APPROXIMATELY 100 FEET EAST OF, AND DOWNGRADIENT FROM, THE WASTE PIT. RELATIVELY SMALL AMOUNTS OF TWO OF THESE VOCS WERE ALSO DETECTED IN MONITORING WELL MW-7A IT IS LIKELY BUT NOT CERTAIN THAT THESE VOCS ARE ORIGINATING FROM THE WASTE PIT TOO. IN SUMMARY, MONITORING DATA DOES SHOW THAT CONTAMINANTS ARE SLOWLY LEAKING FROM THE WASTE PIT.

9. COMMENT

THE ENDANGERMENT ASSESSMENT REPORT STATES THAT 'CURRENT EXISTING HUMAN EXPOSURE TO SITE CONTAMINANTS OCCURS WHEN PEOPLE ENTER THE SITE AND INHALATION OF CONTAMINATED DUST OVER A LONG PERIOD OF TIME POSES A POTENTIAL RISK OF CANCER'. THE SITE IS CLOSED DOWN AND THERE WILL BE NO LONG-TERM EXPOSURE, NOR WILL THERE BE ANY SUBSTANTIAL AMOUNT OF DUST SINCE THERE ARE GRASSES GROWING OVER MOST OF THE SITE.

RESPONSE

THE CURRENT RISK CALCULATIONS PERFORMED IN THE ENDANGERMENT ASSESSMENT CONSIDERED TRESPASSERS ENTERING THE SITE FOR THE PURPOSE OF DIRT BIKING. THIS ACTIVITY WAS OBSERVED DURING PERFORMANCE OF FIELD WORK FOR THE REMEDIAL INVESTIGATION. EVEN THOUGH THE SITE IS NOW CLOSED, THE AGENCY ASSUMES DIRT BIKING AND OTHER FORMS OF TRESPASSING ACTIVITIES WILL CONTINUE AND THEREFORE THE RISKS CALCULATED IN THE ENDANGERMENT ASSESSMENT WILL CONTINUE TO EXIST.

10. COMMENT

THE FINDINGS ALSO MENTION THAT 'DIRECT CONTACT WITH AND LONGTERM INGESTION OF SURFACE WATERS, SOILS, AND GROUND WATER COULD RESULT IN AN UNACCEPTABLE LEVEL OF NONCANCEROUS OR CANCEROUS HUMAN HEALTH RISKS'. WHO IS GOING TO DRINK THE GROUND WATER FROM THE SITE OR EAT THE DIRT FROM THE LANDFILL OVER A LONG PERIOD OF TIME OR EVEN OVER A SHORT PERIOD OF TIME? NO ONE, OF COURSE!

RESPONSE

THE FINDINGS REFERRED TO IN THE COMMENT ABOVE CONCERN POTENTIAL FUTURE-USE WHICH MAY BE POSED BY THE SITE IF

IT WERE USED FOR RESIDENTIAL PURPOSES. IT IS THE AGENCY'S POLICY TO CALCULATE RISKS UNDER A REASONABLE WORST CASE SITUATION AS A MEANS OF ESTABLISHING A BASE-LINE FOR COMPARISON OF REMEDIAL ALTERNATIVES. THE AGENCY CHOSE TO USE THE RESIDENTIAL USE SITUATION FOR THE REASONABLE WORST CASE SCENARIO AT THIS SITE. THE ENDANGERMENT ASSESSMENT CALCULATIONS SHOWED THAT POTENTIAL RESIDENTS ON THE SITE COULD BE EXPOSED TO UNACCEPTABLE HEALTH RISKS. THEREFORE, THE AGENCY MUST TAKE MEASURES TO ASSURE THE RISKS ARE MINIMIZED.

11. COMMENT

'PROPOSED [POTENTIALLY] RESPONSIBLE PARTIES', CERTAIN COMPANIES, ARE BEING TOLD THEY HAVE TO 'FORK OUT' 48k MILLION DOLLARS TO CAP THE LANDFILL. IT'S ALREADY ALMOST ALL COVERED WITH TOP SOIL AND PLANTED AND GROWING GRASS. WHY NOT LEAVE IT AS IT IS? IT'S NOT HURTING ANYONE AND I'LL BET WON'T HURT ANYONE IN THE FUTURE. PUT SOME LIMESTONE IN THE CREEKS AND PLANT SOME CATTAILS IN WETLANDS AND IT WILL BE FIXED.

RESPONSE

IT IS TRUE THAT THE SITE IS COVERED WITH SOIL WHICH IS GROWING GRASSES. THE EXISTING COVER, HOWEVER, WAS NOT ENGINEERED TO MINIMIZE INFILTRATION OF WATER, AS IS REQUIRED BY LAW FOR SOLID WASTE LANDFILLS. MINIMIZING INFILTRATION OF SURFACE WATER WILL INHIBIT CONTAMINATION MIGRATION AND DECREASE LEACHATE GENERATION, EFFECTIVELY REDUCING HEALTH AND ENVIRONMENTAL RISKS POSED BY THE SITE. IN ORDER TO ASSURE THAT THE SITE POSES MINIMIZED RISK OVER THE LONG-TERM, A CAP IS A NECESSARY COMPONENT OF THE REMEDY. THE AGENCY DOES INTEND TO USE CONSTRUCTED WETLANDS FOR TREATMENT OF COLLECTED LEACHATE AND GROUND WATER, HOWEVER THE WETLANDS WILL BE PROPERLY DESIGNED TO ASSURE THE COLLECTED WATERS ARE TREATED SUFFICIENTLY TO MEET APPROPRIATE DISCHARGE LIMITS.

12. COMMENT

WE HAVE TO DO AWAY WITH LANDFILLS BECAUSE WE'RE DESTROYING THE LANDS. WE'RE MAKING MORE PEOPLE BUT WE DON'T MAKE MORE LAND. THERE'S 50 ACRES DOWN THERE (THE BUCKEYE SITE) THAT NOBODY CAN USE OR LIVE ON. WE KEEP CONTINUING BUILDING MORE LANDFILLS BUT WE DON'T FIGURE OUT A WAY TO RECYCLE OUR WASTE.

RESPONSE

THE AGENCY FULLY SUPPORTS WASTE MINIMIZATION AND RECYCLING EFFORTS AS A MEANS OF PRESERVING THE ENVIRONMENT. ALSO SEE RESPONSE TO COMMENT 4.

13. COMMENT

THE LANDFILL WAS CONSTRUCTED ON THE MINE SPOILAGE (REFUSE). THE REASON IT WAS CONSTRUCTED ON THE MINE SPOILAGE WAS -- IT WAS A WASTE AREA, WHY NOT PUT A DUMP ON IT. WE'LL PUT OUR GARBAGE ON IT, COVER IT UP, PUT GRASS ON IT WHEN IT IS DONE AND HAVE A NICE AREA WHEN IT WAS DONE. I CERTAINLY BELIEVE THAT'S THE THOUGHT BEHIND THAT LANDFILL.

RESPONSE

THE AGENCY CAN NOT SPECULATE ON WHAT THE INTENTIONS WERE FOR LOCATING THE LANDFILL IN THE KINGS RUN VALLEY.

14. COMMENT

THE THING I FEAR MOST ABOUT YOUR PROPOSAL IS THE COSTS AND ITS BENEFITS. THERE IS AN AWFUL LOT OF ACID MINE DRAINAGE THAT COMES INTO LITTLE MCMAHON CREEK, NOT ONLY FROM THE LANDFILL AREA BUT FROM OTHER AREAS. I CAN'T SEE SPENDING 48.6 MILLION DOLLARS, OR WHATEVER THAT FIGURE IS, WHEN YOU HAVE OTHER AREAS, OTHER ACID MINE DRAINAGE COMING OFF INTO THOSE CREEKS.

RESPONSE

THE REMEDIAL ACTION WHICH HAS BEEN SELECTED FOR THE **BUCKEYE RECLAMATION** LANDFILL SITE IS NOT EXCLUSIVELY A MINE RECLAMATION PROJECT. THE COMPONENTS OF THE REMEDY SERVE TO MINIMIZE INFILTRATION OF SURFACE WATER INTO THE LANDFILLED AREA, COLLECT LANDFILL LEACHATE AND GROUND WATER (MUCH OF WHICH IS ALSO ACID MINE DRAINAGE IMPACTED), TREAT THE COLLECTED WATERS AND POSSIBLY IMPLEMENT INSTITUTIONAL CONTROLS ON THE SITE PROPERTY. THE GOAL OF THE REMEDY IS TO PREVENT OFF-SITE MIGRATION OF CONTAMINANTS AND TREAT CONTAMINATED WATERS WHICH DO MOVE OFF-SITE. ACID MINE DRAINAGE IS NOT THE ONLY PROBLEM IDENTIFIED AT THIS SITE AS EVIDENCED BY THE PRESENCE OF MAN-MADE CHEMICALS.

15. COMMENT

I DON'T KNOW WHETHER BELMONT COUNTY IS GOING TO END UP HAVING TO PAY FOR THIS OR NOT. I FEEL LIKE THE AGENCIES ARE PENALIZING THE LOCAL PEOPLE THAT OWN THAT LANDFILL, CAUSING THEM AND SOME OF THE OTHER DUMPERS TO COME UP WITH ALL THIS MONEY TO REPAIR ALL OF THIS WHEN YOUR STUDIES SHOW THAT ALL THE METALS AND EVERYTHING THAT IS COMING OUT OF THE LANDFILL IS COMING OUT OF THAT ACID MINE DRAINAGE.

RESPONSE

FIRST, BELMONT COUNTY IS NOT THE ONLY POTENTIALLY RESPONSIBLE PARTY AT THIS SITE. THE AGENCY WILL ATTEMPT TO NEGOTIATE AN AGREEMENT WITH A NUMBER OF POTENTIALLY RESPONSIBLE PARTIES (PRPS) FOR THE PERFORMANCE OF THE REMEDIAL DESIGN AND REMEDIAL ACTION. SECOND, THE AGENCY STUDIES SHOW THAT MANMADE CONTAMINANTS, WHICH COULD NOT HAVE COME FROM ACID MINE DRAINAGE, ARE PRESENT AT THE LANDFILL. SAMPLE ANALYSES ALSO SHOWED HIGH CONCENTRATIONS OF METALS, SOME OF WHICH COULD HAVE BEEN RELEASED FROM INDUSTRIAL WASTES DISPOSED AT THE **BUCKEYE RECLAMATION** LANDFILL SITE. THE ACID MINE DRAINAGE IS NOT THE PRIMARY REASON SUPERFUND IS CONDUCTING A REMEDIATION AT THIS SITE.

16. COMMENT

I CAN'T SEE WHERE YOU ARE BEING FAIR IN WANTING TO HAVE PRPS PUT ALL THIS MONEY OUT WHEN THE ORIGINAL INTENT OF THE LANDFILL WAS TO COVER ALL THE MINE REFUSE ANYWAY. I THINK YOU ARE PENALIZING THOSE PEOPLE VERY UNJUSTLY FOR THE BENEFITS THAT WILL BE DERIVED.

RESPONSE

REGARDLESS OF THE ORIGINAL INTENT OF THE LANDFILL, THE STUDIES PERFORMED BY THE AGENCY HAVE CONCLUDED THAT AN ALREADY DEGRADED SITUATION AT THE **BUCKEYE RECLAMATION** LANDFILL SITE WAS MADE WORSE BY LANDFILLING. THE SELECTED REMEDY IS SIMILAR TO THE SORT OF LANDFILL CLOSURE WHICH IS REQUIRED UNDER STATE OF OHIO SOLID WASTE REGULATIONS. ALL SOLID WASTE LANDFILLS IN OHIO ARE REQUIRED BY OHIO LAW TO BE COVERED IN A PROPER MANNER AND PROVIDE FOR LEACHATE COLLECTION AND TREATMENT. THE AGENCY DOES NOT INTEND TO PENALIZE ANY PARTY, ONLY TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT.

COMMENTS 17 THROUGH 27 WERE SUBMITTED BY THE **BUCKEYE RECLAMATION** LANDFILL STEERING COMMITTEE. BECAUSE MOST OF THESE COMMENTS ARE LENGTHY, THEY HAVE BEEN SUMMARIZED IN THIS RESPONSIVENESS SUMMARY. THE COMPLETE COMMENTS CAN BE FOUND IN THE ADMINISTRATIVE RECORD FOR THE **BUCKEYE RECLAMATION** LANDFILL SITE.

17. COMMENT

THE FINAL RI REPORT STATES THAT 'THE FLOW SYSTEM IN THE MINE SPOIL IS COMPLICATED BECAUSE OF ITS HETEROGENEITY. IT INVOLVES NOT A SINGLE, UNIFORM WATER TABLE BUT A SERIES OF SEMI-ISOLATED SATURATED ZONES, SOME WITH FAIRLY EXTENSIVE WATER TABLES, COEXISTING IN PLACES WITH MORE LOCAL,

SEMIPERCHED WATER TABLES.' FINAL RI P. 142. THE CONCLUSIONS EXPRESSED IN THIS QUOTE ARE ENTIRELY WITHOUT SUPPORT AND INCONSISTENT WITH THE INFORMATION AND DATA COLLECTED DURING THE RI. THE DATA COLLECTED DURING THE RI INDICATES THAT THE WATER TABLE (IN THE MINE REFUSE ZONE) IS A SINGLE SATURATED ZONE WHICH EXISTS AT THE BASE OF THE UNCONSOLIDATED MATERIAL, AND OCCURS DUE TO THE PERMEABILITY CONTRAST BETWEEN THE UNCONSOLIDATED MATERIALS AND THE RELATIVELY IMPERMEABLE VIRGIN SOIL HORIZON OR BEDROCK FORMATIONS BELOW (ALTHOUGH LEAKAGE SURELY OCCURS).

RESPONSE

THE AGENCY HAS DETERMINED THAT HYDROLOGIC DESCRIPTION PROVIDED FOR THE MINE REFUSE ZONE IN THE ABOVE COMMENT MAY BE AN OVERSIMPLIFICATION OF THE SITUATION. THE AGENCIES CONTEND THAT DATA FROM THE RI SHOWS THAT IN PLACES WHERE THE MINE REFUSE IS RELATIVELY THIN, AS AT MW-6A (36 FEET) AND MW-11A (17 FEET), IT IS DRY. IN THE OTHER MONITORING WELLS (MW-2A, MW-7A, MW-8A, MW-9A AND MW-12A), WHERE THICKNESSES OF MINE REFUSE RANGE FROM 40 TO 100 FEET, THE MINE REFUSE IS PARTIALLY SATURATED. THEREFORE, MOVING FROM NORTH TO SOUTH WITHIN THE MINE REFUSE ON-SITE, A CONTINUOUS GROUND WATER TABLE MAY NOT BE PRESENT AS IS IMPLIED IN THE ABOVE COMMENT. THE ABOVE COMMENT TOOK SPECIAL EXCEPTION TO THE USE OF 'SEMIPERCHED' IN DESCRIBING THE GROUND WATER CONDITIONS IN THE MINE REFUSE. THIS TERM WAS INTENDED TO DESCRIBED GROUND WATER LEVELS WHICH WERE MEASURED HIGHER UP ON THE RIDGE WHICH SEPARATES KINGS RUN AND UNNAMED RUN. BECAUSE OF THE HETEROGENEITY OF THE MINE REFUSE IN THE LANDFILL AREA, THE AGENCY CONCLUDED THAT SOME OF THESE TOPOGRAPHICALLY HIGHER GROUND WATER MEASUREMENTS COULD HAVE RESULTED FROM RESTRICTED DOWNWARD PERCOLATION OF WATER IN LOCALIZED AREAS.

18. COMMENT

THE DRAFT RI REPORT CONTAINED IMPORTANT OBSERVATIONS AND DATA REGARDING RECHARGE TO BEDROCK FORMATIONS. ALTHOUGH THE DATA WAS CONSISTENT WITH OTHER SITE DATA, THE FINAL RI REPORT IGNORED THE INFORMATION, AND AS A RESULT, FUNDAMENTAL SITE HYDROGEOLOGIC OBSERVATIONS AND DESCRIPTIONS WERE LOST. THIS COMMENT TAKES SPECIAL EXCEPTIONS TO REVISIONS PERFORMED BY THE AGENCIES REGARDING GROUND WATER RECHARGE AND DISCHARGE FROM THE REDSTONE LIMESTONE AND SEWICKLY COAL.

RESPONSE

THE AGENCY DETERMINED THAT CAREFUL EXAMINATION OF DRILLING DATA IS REQUIRED OR ELSE ERRONEOUS CONCLUSIONS MAY BE MADE AS TO WHICH UNITS ARE OR ARE NOT WATER BEARING. AN EXAMPLE OF

WHAT IS BELIEVED TO BE SUCH A MISINTERPRETATION IS THE STATEMENT IN THE ABOVE COMMENT THAT THE SEWICKLEY COAL IS NOT WATER BEARING AT THE SITE. THIS ALL INCLUSIVE STATEMENT IS BASED ON THE LOSS, DURING DRILLING, OF APPROXIMATELY 3750 GALLONS OF WATER IN MW-5C BETWEEN DEPTHS OF 216 AND 295 FEET (A 79-FOOT INTERVAL THAT INCLUDES THE SEWICKLEY COAL), PLUS THE FACT THAT THE WELL, HAVING BEEN 'BLOWN DRY', FAILED TO 'RECHARGE'. THE AGENCY WAS NOT TOLD HOW MUCH TIME WAS ALLOWED TO REENTER THE WELL, A PROCESS THAT CONCEIVABLY COULD TAKE SEVERAL HOURS OR EVEN DAYS. MOREOVER, THERE IS NO EVIDENCE PRESENTED THAT THE WATER WAS INDEED LOST IN THE SEWICKLEY COAL AND NOT IN PERMEABLE ZONES ABOVE OR BELOW THE COAL.

THE STATEMENT ALSO IMPLIED IN THIS COMMENT THAT THE SEWICKLEY COAL AND REDSTONE LIMESTONE ARE 'NATURALLY DRY' BECAUSE THEY 'LACK RECHARGE AREAS' IS NOT CORRECT. BOTH UNITS CROP OUT ON THE SIDES OF THE RIDGE WHERE THEY ARE EXPOSED TO RECHARGE BY PRECIPITATION, SIMILAR TO THE OTHER BEDS THAT UNDERLIE THE SITE.

THE QUESTION OF WHY WELLS MW-1C AND MW-5C WERE DRY WAS NOT ADDRESSED TO THE SATISFACTION OF THE AGENCY IN THIS COMMENT. ACCORDING TO MINE MAPS OF THE OHIO DIVISION OF RECLAMATION, THE PITTSBURGH COAL HAD BEEN ESSENTIALLY MINED OUT, EXCEPT FOR PILLARS AND WALLS REQUIRED FOR ROOF SUPPORT, OVER THE ENTIRE SITE. IT IS COMMON PRACTICE IN UNDERGROUND MINING TO REMOVE, FOR SAFETY REASONS, INCOMPETENT BEDS OF CLAY AND SHALE OVERLYING THE COAL. IT IS THIS MATERIAL THAT MAKES UP MOST OF THE MINE SPOIL NOW PILED ON THE SURFACE. IN THIS INSTANCE, REMOVAL OF THESE OVERLYING BEDS WOULD ALLOW WATER IN THE REDSTONE LIMESTONE TO DRAIN INTO THE ABANDONED MINE, PROBABLY AT A RATE FASTER THAN IT CAN ENTER THE LIMESTONE BY NORMAL RECHARGE.

THE HYPOTHESIS OF DRAINAGE INTO THE UNDERLYING MINES TO ACCOUNT FOR THE ABSENCE OF WATER IN THE REDSTONE LIMESTONE AT WELLS MW-1C AND MW-5C IS STRENGTHENED BY STATEMENTS RELATIVE TO THE REDSTONE LIMESTONE IN THE FINAL RI, P. 164: 'DURING THE DRILLING OF MW-5C, THE DRILL STEM ENCOUNTERED A VOID AND ABRUPTLY DROPPED ONE-HALF FOOT. . .' 'DRILLING FLUIDS WERE RAPIDLY LOST . . . INDICATING SUBSTANTIAL POROSITY AND PERMEABILITY AT MW-5C; HOWEVER, THE FORMATION IS DRY AT THIS LOCATION.' DRAINAGE INTO THE MINE WOULD SEEM A LOGICAL EXPLANATION OF WHY THIS PERMEABLE UNIT WAS DRY AT THESE WELL SITES. THE UNDERLYING MINES MAY NOT BE DRY EVERYWHERE, HOWEVER, BECAUSE OF UNEVENNESS OF THE OLD MINE FLOORS, POSSIBLY ACCOUNTING FOR THE FACT THAT THE REDSTONE LIMESTONE IS WATER BEARING IN PLACES, AS AT THE SITES OF WELLS MW-10C AND MW-12C. IT IS POSSIBLE THAT LOCAL MOUNDING OF THE WATER

TABLE OFFERS INCREASED LOCAL RECHARGE TO THE REDSTONE LIMESTONE AS IS PROPOSED IN THE COMMENT, BUT THE AGENCY BELIEVES DRAINAGE TO THE UNDER GROUND MINE THEORY IS BETTER.

19. COMMENT

THE DRAFT RI REPORT'S OBSERVATION, INDICATING THAT A LARGE SITE SURFACE WATER BODY, THE NORTHERN IMPOUNDMENT, SERVES AS A PRIMARY SOURCE OF RECHARGE FOR THE BENWOOD LIMESTONE WATERBEARING ZONE WAS ERRONEOUSLY EXCLUDED FROM THE FINAL RI REPORT. AS A RESULT, THE FINAL RI REPORT'S DISCUSSION OF LIMITED RECHARGE TO THE BENWOOD FORMATION BY THE NORTHERN IMPOUNDMENT IS BASED ON IMPROPER USE OF SITE DATA AND FLAWED LOGIC.

RESPONSE

THE AGENCY MAINTAINS ITS POSITION THAT THE NORTHERN IMPOUNDMENT IS NOT THE PRIMARY RECHARGE SOURCE FOR THE BENWOOD LIMESTONE. THE ABOVE COMMENT PRESENTED CALCULATIONS WHICH ESTIMATED THE RECHARGE POTENTIAL TO THE BENWOOD FROM BOTH THE MINE REFUSE AT THE BENWOOD SUBCROP AND THE NORTHERN IMPOUNDMENT. THE CALCULATIONS CONCLUDED THAT THE NORTHERN IMPOUNDMENT MAY HAVE 2 TO 5 TIMES THE RECHARGE POTENTIAL OF THE SUBCROP. THESE CALCULATIONS, HOWEVER FAIL TO TAKE INTO ACCOUNT THE SEDIMENTS AT THE BOTTOM OF THE NORTHERN IMPOUNDMENT, WHICH SHOULD REDUCE DISCHARGE FROM THE IMPOUNDMENT. IN THE CONCLUDING STATEMENT OF THE FINAL RI REPORT, THE AGENCY DID NOT DISCOUNT THE NORTHERN IMPOUNDMENT AS A RECHARGE SOURCE, ONLY THAT IT IS NOT THE MAJOR RECHARGE SOURCE.

20. COMMENT

THE FINAL RI REPORT (P. 211) NOTES THAT NW-10C AND MW-3B COULD NOT BE PROPERLY DEVELOPED BECAUSE OF EXCEPTIONALLY LOW YIELDS. DESPITE THESE DEFICIENCIES, THE AGENCIES REQUIRED THAT DATA FROM THESE WELLS BE USED IN THE ENDANGERMENT ASSESSMENT (FINAL EA REPORT, P.2-9) IN CALCULATING POTENTIAL HUMAN EXPOSURE TO GROUND WATER. IT IS NEVER NECESSARY OR PROPER TO USE DATA WHEN THERE IS STRONG REASON TO SUSPECT THAT THE DATA IS SPURIOUS. IN BOTH INSTANCES, OTHER WELLS IN THE SAME FORMATION ARE AVAILABLE TO PROVIDE ADEQUATE INFORMATION TO ESTABLISH THE TRUE WATER QUALITY USE OF DATA FORM UNDEVELOPED WELLS IS CONTRARY TO NUMEROUS EPA GUIDANCE ON GROUND WATER MONITORING. IT IS UNACCEPTABLE TO USE SPURIOUS DATA BY CLAIMING THAT ITS USE IS A CONSERVATIVE ASSUMPTION. THE DATA IS INVALID AND MEANINGLESS. MOREOVER, THE DATA CANNOT BE CONSIDERED VALID, MEANINGFUL, OR 'CONSERVATIVE' SIMPLY BECAUSE SIMILAR 'NUMBERS' ARE OBTAINED

FROM VALID DATA.

RESPONSE

THE AGENCY MAINTAINS ITS POSITION THAT ANALYTICAL DATA FROM THESE WELLS IS VALID. THE DATA FROM THESE WELLS WAS VALIDATED THROUGH LABORATORY AND AGENCY QA/QC PROCEDURES. IN THIS INSTANCE, THE AGENCY STATED THAT INCLUSION OF THE DATA WAS A 'CONSERVATIVE APPROACH', NOT IN TERMS OF ESTIMATING THE HEALTH RISKS POSED BY THE SITE, BUT IN TERMS OF THE UNCERTAINTY OF THE SOURCE OF CONTAMINANTS DETECTED IN THE WELL. THE AGENCY WAS NOT CONVINCED THAT THE CHEMICALS OF CONCERN PRESENT IN THE SAMPLE WERE DERIVED MERELY FROM WELL INSTALLATION PROBLEMS, THEREFORE THE DATA FROM THESE WELLS WAS INCLUDED IN THE ENDANGERMENT ASSESSMENT.

21. COMMENT

THE FINAL ENDANGERMENT ASSESSMENT (EA) REPORT ASSUMES AN UNREASONABLE FUTURE RESIDENTIAL USE SCENARIO WHERE LOCAL STREAMS ARE USED AS A PRIMARY DRINKING WATER SOURCE, EVEN THOUGH INGESTION OF SURFACE WASTER IS 'NOT EXPECTED TO BE A MAJOR OR PROBABLE EXPOSURE ROUTE' (FINAL EA REPORT, P. 3-28), AND 'INGESTION OF UNTREATED SURFACE WATER PROBABLY CONSTITUTES THE LEAST LIKELY EXPOSURE PATHWAY DUE TO THE POOR AESTHETIC QUALITY OF THE STREAM WATER (I.E, DISCOLORATION AND PALATABILITY EFFECTS DUE TO ACID MINE DRAINAGE CONDITIONS', FINAL EA REPORT, P. 5-16). RISKS CALCULATED UNDER THIS SCENARIO PROVIDE AN INAPPROPRIATE AND MISLEADING CHARACTERIZATION OF BRL SITE-RELATED RISKS.

RESPONSE

THE AGENCY DETERMINED THAT CALCULATING FUTURE RESIDENTIAL RISKS FOR INGESTION OF SURFACE WATER (AS A PRIMARY DRINKING WATER SOURCE) IN THIS AREA WAS JUSTIFIED. DURING THE RESIDENTIAL SURVEY, WELLS WHICH WERE INSTALLED INTO THE ALLUVIAL AQUIFER ADJACENT TO LITTLE MCMAHON CREEK WERE IDENTIFIED. THERE IS A POSSIBILITY THAT THE WATER ENTERING THESE WELLS IS COMING DIRECTLY FROM LITTLE MCMAHON CREEK. ANOTHER CONSIDERATION UNDER THE FUTURE USE SCENARIO WAS THAT, BECAUSE WATER BEARING ZONES UNDER THE SITE DO NOT PRODUCE LARGE AMOUNTS OF WATER, SURFACE WATER MAY BE THE ONLY VIABLE SOURCE OF WATER IN AN ON-SITE RESIDENTIAL SCENARIO.

22. COMMENT

THE ENDANGERMENT ASSESSMENT (EA) ATTEMPTED TO EXAMINE 'THE POTENTIAL HEALTH AND ENVIRONMENTAL EFFECTS WHICH MAY BE ASSOCIATED WITH CONTAMINANTS IN THE ENVIRONMENTAL MEDIA AT

THE **BUCKEYE RECLAMATION** LANDFILL.' FINAL EA REPORT, EXECUTIVE SUMMARY. THE EA IS BASED ON THE ANALYTICAL RESULTS OF SAMPLES COLLECTED DURING THE RI. THE RESULTS OF SUCH AN ASSESSMENT CAN ONLY BE MEANINGFUL IF THE ANALYTICAL METHODS USED ARE SENSITIVE ENOUGH TO ACCURATELY DETERMINE THE LEVELS OF CONTAMINANTS PRESENT IN THE SAMPLES BEING ANALYZED. THE ANALYTICAL METHODS USED IN THE RI WERE SELECTED BASED ON WHAT WAS UNDERSTOOD TO BE THE EXPOSURE PATHWAYS THAT WOULD BE CONSIDERED IN THE EA, AND THE SENSITIVITY OF THE SELECTED METHODS PROVIDED RESULTS THAT CAN BE USED TO CHARACTERIZE THE RISK OF THOSE PATHWAYS. FOR EXAMPLE, FOR DERMAL EXPOSURE THE ANALYTICAL RESULTS ALLOWED FOR AN ACCURATE CALCULATION OF RISK AND INDICATED THAT THE TOTAL PATHWAY HAZARD INDICES AND CANCER RISKS FROM DERMAL CONTACT WITH SURFACE WATER WERE WELL WITHIN THE ACCEPTABLE RANGE. THE SELECTED ANALYTICAL METHODS, HOWEVER WERE NOT SENSITIVE ENOUGH TO PROPERLY CHARACTERIZE THE RISK CREATED BY A SURFACE WATER INGESTION SCENARIO.

ANALYTICAL METHODS WITH VERY LOW LIMITS OF DETECTION WERE NOT USED BECAUSE EXPOSURE THROUGH SURFACE WATER INGESTION WAS NOT CONSIDERED TO BE A REALISTIC OR EVEN PROPER EXPOSURE SCENARIO. AS A RESULT, THE ANALYTICAL METHODS USED DO NOT PROVIDE THE LOW DETECTION LIMITS THAT ARE NEEDED TO PROPERLY CHARACTERIZE RISK ASSOCIATED WITH A WATER INGESTION SCENARIO. DESPITE THE LACK OF APPROPRIATE ANALYTICAL SENSITIVITY, THE FINAL EA REPORT ADDED A SURFACE WATER EXPOSURE PATHWAY AND ASSUMED THAT EACH NON-DETECTED CONTAMINANT WAS PRESENT AT ITS ANALYTICAL DETECTION LIMIT. THUS, ALL SAMPLES WERE ASSUMED TO HAVE CONTAMINANTS PRESENT AT LEAST AT THE ANALYTICAL LEVEL OF DETECTION.

THIS FUNDAMENTALLY FLAWS THE EA PROCESS BECAUSE THE MINIMUM DETECTION LEVELS FOR THE ANALYTICAL METHODS USED, THE LOWEST LEVEL POSSIBLE UNDER THE ASSUMPTIONS USED IN THE FINAL EA REPORT, PRESENT UNACCEPTABLE RISKS.

RESPONSE

DATA USED IN THE CALCULATION OF RISK IN THE EA WAS FIRST SCREENED USING SEVERAL CRITERIA. ONE OF THE FIRST REQUIREMENTS FOR A CONTAMINANT TO BE CONSIDERED PRESENT IN A MEDIA WAS THAT IT WAS DETECTED, EITHER AT ESTIMATED OR ABOVE DETECTION LIMIT CONCENTRATIONS. IF A CHEMICAL WAS NOT DETECTED IN A CERTAIN MEDIA, RISKS WERE NOT CALCULATED FOR THAT CHEMICAL IN THAT MEDIA. IF A CONTAMINANT WAS DETECTED AT ONE SAMPLING POINT IN A SPECIFIC MEDIA, IT WAS CONSIDERED TO BE PRESENT THROUGHOUT THE MEDIA, AT THE DETECTION LIMIT. THE GUIDANCE UNDER WHICH THIS DOCUMENT WAS PREPARED, THE SUPERFUND PUBLIC HEALTH EVALUATION MANUAL (SPHEM), ALLOWS

LATITUDE IN SELECTING ONE-HALF OR FULL DETECTION LIMITS FOR PERFORMING CALCULATIONS. THE AGENCY CHOSE TO USE THE FULL DETECTION LIMIT FOR EA CALCULATIONS BECAUSE A CONSERVATIVE APPROACH WAS DESIRED AND THIS OPTION WAS AVAILABLE IN THE AGENCY GUIDANCE. IF A CONTAMINANT IS PRESENT IN A MEDIA AND THAT MEDIA PROVIDES A COMPLETE EXPOSURE PATHWAY, THE AGENCY MUST ESTIMATE THE RISKS ASSOCIATED WITH THE PATHWAY.

23. COMMENT

CALCULATION OF RISK IN THE FINAL EA REPORT EMPLOYS METHODOLOGIES THAT POOL DATA FROM SEVERAL SURFACE WATER SAMPLING STATIONS TO DERIVE MEAN CONTAMINANT CONCENTRATIONS FOR USE IN EXPOSURE CALCULATIONS. THE WAY IN WHICH THE DATA FROM THE SURFACE WATER STATIONS WAS POOLED RESULTED IN GROUPINGS OF DATA THAT MAKE IT IMPOSSIBLE TO MEANINGFULLY COMPARE THE RISK CAUSED BY LANDFILLING ACTIVITIES WITH THE RISK CREATED BY ACID MINE DRAINAGE ('AMD') FROM THE MINE REFUSE AT THE SITE OR IN THE SURROUNDING AREA.

RESPONSE

THE GROUPINGS OF THE SURFACE WATER DATA USED TO DERIVE THE MEAN CONTAMINANT CONCENTRATIONS WERE DEVELOPED JOINTLY BY THE SITE STEERING COMMITTEE AND THE AGENCY. AT THE TIME, ALL PARTIES AGREED THAT THIS GROUPING WOULD BEST ASSESS THE HEALTH EFFECTS POSED BY THE SITE. A MAJOR ISSUE DISCUSSED WAS HOW APPLICABLE THE UNNAMED RUN SURFACE WATER STATION (BY6) DATA WAS FOR BRL SITE COMPARISONS. THE UNNAMED RUN IS NOT IMPACTED BY LANDFILLING BUT IS GREATLY IMPACTED BY ACID MINE DRAINAGE (AMD). BECAUSE UNNAMED RUN IS IN A DIFFERENT DRAINAGE BASIN IN WHICH THERE HAS BEEN NO RECLAMATION ACTIVITY SIMILAR TO THAT WHICH HAS OCCURRED IN THE KINGS RUN BASIN, THE AGENCY DETERMINED THAT ANY RISKS CALCULATED USING ONLY UNNAMED RUN DATA WOULD OVERSTATE SITE RELATED AMD EFFECTS. FOR THIS REASON, THE AGENCY DETERMINED THE DATA GROUPINGS USED IN THE FINAL EA BEST ASSESSED SITE RISKS.

24. COMMENT

THE USE OF STORM WATER FLOW DATA IN DERIVING MEAN CONTAMINANTS CONCENTRATIONS FOR USE IN EXPOSURE MODELING IS IMPROPER AND UNREALISTIC. BY COMBINING TWO ROUNDS OF STORM WATER DATA WITH BASEFLOW DATA IN THE CALCULATION OF MEAN CONTAMINANT CONCENTRATIONS, THE RESULTS OF THE FINAL EA REPORT ARE INAPPROPRIATELY SLANTED TOWARD STORM CONDITIONS. BASEFLOW CONDITIONS ARE MORE TYPICALLY PRESENT IN THE STREAM. STORM WATER FLOW IN THESE STREAMS IS A BRIEF, RARE EVENT. USING BOTH SETS OF THE DATA CAUSES THE EXPOSURE SCENARIO TO EFFECTIVELY MODEL A SITUATION WHERE A MAJOR STORM EVENT

OCCURS HALF OF THE TIME. GIVING EQUAL WEIGHT TO BOTH SETS OF DATA RESULTS IN A MEAN CALCULATION THAT IS INAPPROPRIATE AND NOT REPRESENTATIVE OF SITE CONDITIONS.

WHEN CALCULATIONS IN THE FINAL EA REPORT ARE RECALCULATED WITH ONLY BASEFLOW DATA INCLUDED, HAZARDS AND RISKS ARE GREATER IN THE PRE-LANDFILL CONDITION THAN AT THE BRL SITE.

RESPONSE

THE AGENCY INSISTED ON COLLECTION OF STORM FLOW SURFACE WATER SAMPLES IN ORDER TO EVALUATE POTENTIAL MAXIMUM CONTAMINANT RELEASES IN THIS PATHWAY. ANALYTICAL DATA FROM THESE STORM FLOW SAMPLES DID SHOW HIGHER CONTAMINANT LEVELS THAN THOSE FOUND IN BASE FLOW SAMPLES. THE ABOVE COMMENT AND APPENDIX TO THE COMMENT PROPOSES TO IGNORE THE DATA AND ONLY INCLUDE BASE FLOW DATA IN CALCULATING RISKS FROM THIS PATHWAY. THE AGENCY DETERMINED THE TWO SETS OF DATA SHOULD BE COMBINED IN ORDER TO FULLY EVALUATE RISKS POSED BY THE PATHWAY.

25. COMMENT

THE DRAFT RI REPORT PROVIDED IMPORTANT OBSERVATIONS RELATED TO THE POTENTIAL FOR THE BRL SITE TO IMPACT LOCAL STREAMS BY NOTING THAT BRL SITE-RELATED CONTAMINANTS IN SURFACE WATER ARE THE SAME METAL CONTAMINANTS, AND IN SIMILAR CONCENTRATIONS AS FOUND IN THE AMD. IT IS ALTOGETHER REASONABLE AND PROPER TO CONTRAST POTENTIAL FUTURE IMPACTS FROM ALL SOURCES OF CONTAMINATION IN DISCUSSING THE LIKELIHOOD THAT THE ALLUVIAL AQUIFER WILL BE IMPACTED BY THE BRL SITE IN THE FUTURE.

THE DRAFT RI REPORT (P. 407) ALSO NOTED THE ELEVATED CONCENTRATIONS OF METALS FROM MINE SPOIL LEACHATE IN THE UNNAMED RUN DRAINAGE HAVE BEEN ACTING ON THIS AQUIFER FOR OVER 60 YEARS, YET NO MCLS FOR THESE CONTAMINANTS WERE EXCEEDED IN DOMESTIC WELL SAMPLES. THERE WERE VERY FEW OCCURRENCES OF VOLATILE OR SEMIVOLATILE CONTAMINANTS DETECTED IN SURFACE WATERS RECHARGING THIS AQUIFER AND VALUES FOR CONTAMINANTS THAT WERE DETECTED WERE AT OR NEAR DETECTION LIMITS. IN ADDITION, THE HIGHLY MOBILE ORGANIC CONTAMINANTS THAT COULD CONCEIVABLY BE COMING FROM THE WASTE PIT HAVE NOT BEEN DETECTED IN SURFACE WATER AND ARE IN LOW CONCENTRATIONS IN ON-SITE GROUND WATER. SEMIVOLATILE COMPOUNDS WERE NOT SHOWN TO HAVE CONTAMINATED SURFACE WATER. SEMIVOLATILE COMPOUNDS WERE DETECTED IN WELLS NEAR THE WASTE PIT BUT ONLY AT VERY LOW CONCENTRATIONS. SHOULD ANY OF THESE ORGANIC CONTAMINANTS IN ON-SITE GROUND WATER REACH THE SURFACE WATERS, NATURAL DILUTION WOULD REDUCE THE CURRENTLY VERY LOW CONCENTRATIONS TO BELOW ANALYTICAL DETECTION. THUS FUTURE

CONTAMINATION OF THE ALLUVIAL AQUIFER, AND THE DOMESTIC WELLS IS EXTREMELY UNLIKELY.

RESPONSE

THE AGENCY CANNOT SPECULATE ON THE WATER QUALITY IN THE LOCAL PRIVATE WELLS OVER THE PAST 60 YEARS, NO MATTER WHAT CONTAMINANT RELEASES MAY HAVE OCCURRED IN THE AREA. WITH NO REAL DATA TO ESTABLISH THE WATER QUALITY IN THE DOMESTIC WELLS IN THE 60 YEARS PRIOR TO RI ACTIVITIES, IT IS DIFFICULT TO CLAIM THAT THE WELLS HAVE NEVER BEEN IMPACTED BY THE SITE AND THEREFORE WILL NOT BE IMPACTED BY THE SITE IN THE FUTURE. RESIDENTIAL WELLS WERE SAMPLED DURING RI ACTIVITIES FOR THE SITE AND THE FINAL EA STATES THAT NO UNACCEPTABLE NONCANCER HAZARDS WERE IDENTIFIED FOR THE INDICATOR ANALYTES DETECTED IN OFF-SITE RESIDENTIAL WELL WATER (EA REPORT, EXECUTIVE SUMMARY). IT IS UNLIKELY THAT THE SITE IS IMPACTING THESE WELLS GIVEN THE DATA COLLECTED FOR THE RI. IN THIS CASE, THE AGENCY CHOSE TO RELY ON DATA COLLECTED DURING THE INVESTIGATION AND NOT SPECULATE ON THE PAST. WHILE CURRENT ALLUVIAL GROUND WATER RISKS ARE LOW, THE AGENCY CHOSE A COURSE OF ACTION TO ASSURE THAT FUTURE EXPOSURES ARE LOW RISK AS WELL.

26. COMMENT

IN THE DRAFT ENDANGERMENT ASSESSMENT (EA) REPORT (AUGUST, 1989), THE WORST CASE CURRENT SOIL EXPOSURE MODELED A PAIR OF DIRT BIKERS, ONE FOLLOWING THE OTHER WHILE TRESPASSING ON THE BRL SITE AS IT EXISTED AT THE TIME OF THE REMEDIAL INVESTIGATION. THIS SCENARIO WAS CONSISTENT WITH OBSERVATIONS WAS MADE BY THE LANDFILL OPERATORS AND THOSE MADE BY THE REMEDIAL INVESTIGATION FIELD TEAM DURING THE REMEDIAL INVESTIGATION. IN THIS SCENARIO, THE SECOND BIKER IN THE PAIR WOULD BE MORE EXPOSED THAN ANY OTHER PERSON WHO MIGHT COME INTO CONTACT WITH THE SITE. THE FINAL EA REPORT, HOWEVER, NOTING THAT OTHER TYPES OF VEHICLES USE THE AREA AND OTHER RECEPTORS SUCH AS HUNTERS AND HIKERS MAY ALSO BE ON SITE AT TIMES, MATERIALLY ALTERED THE INPUTS TO THE MODEL BY USING WORST CASE VALUES FOR ALL PARAMETERS IN THE MODEL. THE MODEL BY DEFINITION PRESENTS A WORST-CASE, AND THE FINAL EA REPORT'S SELECTION OF ALL WORST-CASE VARIABLES AS INPUTS CAUSES THE OUTPUT FROM THE MODEL TO BE SO UNREALISTIC THAT IT IS MEANINGLESS.

RESPONSE

THE ABOVE COMMENT MAINTAINS THAT VIRTUALLY ALL PARAMETERS, SELECTED BY THE AGENCY FOR THE DUST GENERATION MODEL, WERE TOO CONSERVATIVE OR UNREALISTIC. THE AGENCY CAREFULLY

REVIEWED THE DRAFT EA REPORT. IT CONTAINED PARAMETERS WHICH WERE DETERMINED, BY THE AGENCY, TO BE EITHER INCORRECT OR NOT CONSERVATIVE ENOUGH. PARAMETER VALUES RECOMMENDED BY THE AGENCY WERE THEN TAKEN FROM GUIDANCE (COMPILATION OF AIR POLLUTANT EMISSION FACTORS: VOLUME 1: STATIONARY POINT AND AREA SOURCES. AP-42, 4TH EDITION, U.S. EPA, SEPTEMBER, 1985 AND SUPERFUND EXPOSURE ASSESSMENT MANUAL. EPA/540/1-88/001, OSWER DIRECTIVE 9285.5-1. APRIL, 1988) AFTER THE AGENCY HAD CONSIDERED SITE CONDITIONS, AND EXAMINED PARAMETERS WHICH BEST FIT SITE CONDITIONS AND THE MODEL WHICH WAS BEING USED. THE AGENCY MAINTAINS THAT ALL ASSUMPTIONS BEST REPRESENTED SITE CONDITIONS AND BEST SUITED THE MODEL USED FOR THE CALCULATIONS.

27. COMMENT

AMBIENT AIR SAMPLES WERE COLLECTED DURING THE REMEDIAL INVESTIGATION (FINAL RI REPORT, SECTION 6.0). AIR SAMPLING DATA INDICATED THERE WAS NO RISK TO HUMAN HEALTH BECAUSE THE CONCENTRATIONS DETECTED WERE MORE THAN A THOUSAND TIMES LESS THAN THE PERTINENT HEALTH BASED STANDARD, THE OSHA PEL. AT THE TIME OF THE AIR SAMPLING, THE SAMPLES COLLECTED IN THE WASTE PIT AREA WERE COLLECTED DIRECTLY DOWNWIND OF THE ACTIVE LANDFILL AREA AND THE MOST-WIDELY USED HAUL ROAD. THE SAMPLING AREAS WERE APPROXIMATELY 100 TO 900 FEET DOWN WIND OF THE ACTIVE LANDFILL AND THE HAUL ROAD, AND SO THE LOCATIONS OF SAMPLES ARE REASONABLY CONSISTENT WITH A 100YARD DISTANCE FROM THE SOURCE USED IN THE MODEL (ONE SAMPLE IS CLOSER, THE OTHER MORE DISTANT). THEREFORE, THE MODEL CAN BE USED TO CALCULATE RISK AT THE SAMPLING LOCATIONS, WITH THE GARBAGE HAULING VEHICLES ON THE HAUL ROAD CONSIDERED AS THE SOURCE OF DUST. THESE CALCULATIONS CAN THEN BE COMPARED TO RISK CALCULATED USING ACTUAL AIR SAMPLING DATA OBTAINED AT THE SITE TO CALIBRATE THE MODEL. COMPARING THE EXPOSURE RISK CALCULATED FROM ACTUAL CHROMIUM AIR SAMPLING DATA WITH RISK ARRIVED AT BY USING THE MODEL, SHOWS TWO ORDERS OF MAGNITUDE DIFFERENCE IN RISK. THAT IS, THE AGENCIES VARIABLES RESULT IN A RISK THAT IS 100 TIMES MORE SEVERE THAN THE RISK INDICATED BY ACTUAL DATA.

RESPONSE

THE AGENCY FINDS THE DIFFERENCE IN THE RISKS DETERMINED FROM THE TWO METHODS REFERRED TO IN THE ABOVE COMMENT ACCEPTABLE. DATA COLLECTED DURING AIR SAMPLING AT THE SITE LIKELY REPRESENTS TYPICAL CONDITIONS AT THE SITE. THE RISK CALCULATIONS FOR INHALATION OF FUGITIVE DUST ATTEMPTED TO ESTIMATE THE WORST CASE CONDITIONS, WHICH WERE NOT PRESENT ON SITE WHILE THE AIR SAMPLING WAS BEING CONDUCTED. THE RESULTS GIVEN IN THE ABOVE COMMENT CONCLUDE ESSENTIALLY THAT WORST

CASE RISKS ARE APPROXIMATELY TWO ORDERS OF MAGNITUDE GREATER THAN AVERAGE CONDITIONS.

4. REMAINING CONCERNS

ISSUES AND CONCERNS THAT THE AGENCY WAS UNABLE TO ADDRESS DURING REMEDIAL PLANNING ACTIVITIES INCLUDE THE FOLLOWING:

* EFFECTIVENESS OF CONSTRUCTED WETLANDS TREATMENT.

  THE AGENCY PLANS TO CONDUCT A PILOT-SCALE TREATABILITY STUDY DURING REMEDIAL DESIGN TO FURTHER EVALUATE THE EFFECTIVENESS OF THE WETLANDS TREATMENT SYSTEM. A BENCH-SCALE TREATABILITY STUDY IS BEING COMPLETED AND PRELIMINARY INDICATIONS FOR EFFECTIVENESS OF CONTAMINANT REMOVAL ARE FAVORABLE.

* HYDROGEOLOGIC DATA GAPS.

  IN ORDER TO DESIGN THE LEACHATE AND GROUND WATER COLLECTION SYSTEM FOR THIS SITE, ADDITIONAL HYDROGEOLOGIC STUDIES WILL NEED TO BE PERFORMED DURING THE REMEDIAL DESIGN.

ADMINISTRATIVE RECORD INDEX
BUCKEYE RECLAMATION LANDFILL SITE
ST. CLAIRSVILLE, OHIO

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ADMINISTRATIVE RECORD INDEX - UPDATE #1
BUCKEYE RECLAMATION LANDFILL SITE
ST. CLAIRSVILLE, OHIO

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GUIDANCE DOCUMENTS INDEX - UPDATE #1
BUCKEYE RECLAMATION LANDFILL SITE
GUIDANCE DOCUMENTS ARE AVAILABLE FOR REVIEW AT
USEPA REGION V-CHICAGO IL

TITLE	AUTHOR	DATE
DESIGN MANUAL CONSTRUCTED WETLANDS AND AQUATIC PLANT SYSTEMS FOR MUNICIPAL	U.S.EPA/ORD/CERI	88/09/00

WASTEWATER TREATMENT
EPA/625/1-88/0022

ADMINISTRATIVE RECORD INDEX - UPDATE #2
BUCKEYE RECLAMATION LANDFILL SITE
ST. CLAIRSVILLE, OHIO

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MEMORANDUM

SUBJECT: Request for Comment on "Approach for Addressing Current and Reasonably Expected Future Land and Ground Water Use for Risk Management Under Superfund"

FROM: David Cooper, Chair
Superfund Risk Management Workgroup

TO: Superfund Risk Management Workgroup Members (see attached)

Attached for your comment and review you will find a draft of the directive "Approach for Addressing Current and Reasonably Expected Future Land and Ground Water Use for Risk Management Under Superfund." This directive is the outcome of our discussions at the April workgroup meeting and the subsequent discussions with the Superfund Branch Chiefs, Division Directors, and Headquarters management. The directive has been also been distributed to the Waste Management Division Directors for discussion and comment at the their October meeting in Salt Lake City. In addition to comments on the entire draft, we would specifically like to solicit your ideas on the following:

- The workgroup discussed using 10 years as the cutoff point for considering future land use, i.e. land use projections beyond 10 years would not be considered in the baseline risk assessment, nor in the final remediation decision. This cutoff is intended to prevent unsubstantiated speculation concerning potential residential land use in the future. It has not been included in the attached draft. Does the workgroup still prefer a time limitation on future land use? A different cutoff time?

- The draft discusses ground water use in terms of whether or not ground water will be needed as a water supply in the "near term". As you may remember, the workgroup could not agree on a specific timeframe that was justifiable. Do you have any additional comments?

- o Will the changes proposed in this draft have an adverse impact on PRP-lead remedies that are underway? For example, PRPs could request that remediation levels be changed to less stringent levels or request use of longer ground-water remediation timeframes than those required in the ROD.

Please keep this draft internal, OGC has indicated that the ongoing NCP litigation is sensitive to some of these policies.

Written comments can be sent to Sharon Frey, Hazardous Site Control Division, OERR, Mail Code 5203G, or faxed to (703) 603-9100. If you have any questions, please do not hesitate to call either Sharon at 703-603-8772 or me at 703-603-8763. Comments would be appreciated by November 6, 1992.

Attachment

Superfund Risk Management Workgroup Members

Dennis Heubner, Region I
Sarah Levinson, SRO
Bill McCabe, Region II
Eric Johnson, Region III
Debra Forman, Region III
Elmer Aiken, Region IV
John Kelley, Region V
Marilou Martin, Region V
Don Williams, Region VI
Bob Morby, Region VII
Dave Crawford, Region VII
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Steve Golian, DOE
Bob Carr, OPPE
Justina Fugh, OE

cc: Jerry Clifford, HSCD
John Harris, ROGB

Approach for Addressing Current and Reasonably Expected Future Land and Ground Water Use for Risk Management Under Superfund

Purpose:

To present EPA's approach for addressing current and reasonably expected future land use and ground water use for risk management under Superfund.

Background

Since EPA has limited resources and, therefore can not restore all land and ground water to pristine conditions, the Agency has focussed on protection of human health and the environment. The degree of both present and future human exposure, which is affected by the land and ground water use, determines the amount of remediation necessary to ensure protection. Thus, remedial decisions have a significant impact on long- and short-term land and ground water use.

During the RI/FS process, remedial action objectives, the goals for cleanup action at Superfund sites, are generally developed based on decisions about the most appropriate land use and ground water use for the site. During the RI (or site assessment phase under SACM), the baseline risk assessment is conducted. Current land and ground water use determines the populations that may be at risk and the levels of contamination to which they may be exposed. Likewise, projected future resource use is a factor in determining the potentially exposed populations and therefore, the remediation levels considered protective for future use.

Often residential use is assessed in the baseline risk assessment, even though the final remedial action objective(s) is likely to be cleanup for industrial or other non-residential use. During the baseline risk assessment, especially if early in the site assessment process, the final remedial action objectives may not have been established and the future resource use may not yet known. Further, it is also possible that initial remedial action objectives, and the associated projected future resource use(s), may not be practicable to achieve, especially if those objectives are to restore the resource to residential land use remediation levels. Conversely, selection of an industrial risk at the 10-6 level may result in levels that would be equivalent to residential levels that are at the upper end of the risk range. Consequently, the baseline risk assessment may consider several exposure scenarios associated with different land or ground water use options. This provides risk managers with information that can help in their decision making.

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Regardless of the number and variety of exposures and land uses considered in the baseline risk assessment, remedies are selected based on an analysis of the nine evaluation criteria. The nine criteria analysis may be used to determine what land use can cost-effectively be achieved. Generally the protective alternative that utilizes permanence and treatment to the maximum extent practicable and is cost effective to achieve is selected.

Ground Water Policy

EPA recognizes the special nature of ground water as a resource when developing remedial action objectives. The preamble to the National Contingency Plan (NCP) contains a significant discussion of Superfund ground-water remediation policy (55 Fed. Reg. 8732-8735, March 8, 1990). The preamble states:

> The goal of EPA's approach is to return usable ground waters to their beneficial uses within a time frame that is reasonable given the particular circumstances... It is EPA policy to consider the beneficial use of the water and to protect against current and future exposures. Ground water is a valuable resource and should be protected and restored if necessary and practicable.

The preamble also indicates that characteristics of ground water will help determine timeframes for remediation.

> Reasonable time frames may range from very rapid (1-5 years) to relatively extended (perhaps several decades). EPA's preference is for rapid restoration of Class I ground waters and contaminated ground waters that are currently, or likely in the near-term to be, the source of a drinking water supply. The most appropriate time frame must, however, be determined through an analysis of alternatives.

Subsequent to the NCP, EPA issued a ground water protection strategy, "Protecting The Nation's Ground Water: EPA's Strategy for the 1990s," (July 1991, 21Z-1020). This policy states:

Ground-water remediation activities must be prioritized to

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[1] "EPA developed the concept of reasonable maximum exposure to include all exposures that can reasonably be expected to occur, but does not focus on worst-case exposure assumptions" 55 Fed. Reg. at 8713 (emphasis added).

> limit the risk of adverse effects to human health first and then to restore currently used and reasonably expected sources of drinking water and ground water closely hydrologically connected to surface waters, whenever such restorations are practicable and attainable...in making remediation decisions, EPA must take a realistic approach to restoration based upon actual and reasonably expected uses of the resource as well as social and economic values.

__Objective__

The objective of this directive is to match remedial action objectives with realistic and practicable future land and ground water use expectations, thus allowing for protective remedies consistent with the appropriate resource use.

__Implementation__

__Expectations for Reasonably Expected Use__

EPA has developed the following expectations to aid EPA decision makers in understanding and using the assumptions that generally will be made when assessing baseline risk and establishing remedial action objectives. These expectations are a general approach to making land and ground water use assumptions.

In developing remedial action objectives, EPA has a bias for assuming that current resource use will not change in the future. For example, it should generally be assumed that land utilized for residential purposes is assumed to remain residential, industrial lands will remain industrial, and landfills will remain waste management units.

However, EPA recognizes that there may be good reasons why assumptions for future resource use, and the associated remediation objectives, may change. Local or regional land use plans, or local zoning which alters land use may be considered in establishing remedial action objectives. At the same time, EPA is not responsible for making a site developable; EPA is merely responsible for protecting human health and the environment. The NCP at section 300.515(f) states that the Superfund program can accommodate enhancement or expansions of remedies on the condition that the state fund and supervise the change or expansion, and that those enhancements are not inconsistent with the CERCLA remedy.

If it is not practicable to achieve a cleanup consistent with current use, EPA will select a remedy that is protective of human health and the environment but which may result in a more limited use of the land. Costs, technological or administrative feasibility may limit ability to achieve levels protective for current land use.

Very large sites can be conceptually subdivided in to multiple land uses. For example, many Federal Facility sites, because of their size and complexity, will likely be considered to include multiple land uses.

In order to make an informed and timely decision concerning future land use, EPA will solicit information pertinent to the projected future land use of the site and surrounding areas as early as possible in the remedial process. Efforts may include but are not limited to obtaining development plans, zoning laws, zoning maps, deed restrictions, projected population growth, access to the site, and site location in relation to urban, commercial, industrial, and recreational areas. EPA's decision on land use will not necessarily be based on such plans, however, if such plans do not lead to a remedy that meets the statutory mandates of protection of human health and the environment, ARAR compliance, cost-effectiveness, and use of treatment to the maximum extent practicable.

Where unrestricted land use will not be achieved by the remedy (e.g. non-residential land use), institutional controls should be considered as component of the remedy, as stated in the NCP expectations. These institutional controls will supplement engineering controls to prevent or limit exposure to hazardous substances, pollutants, or contaminants and ensure that the land use that served as the basis for developing cleanup levels is not changed.

Expectations for Ground Water Remediation Timeframes

Where EPA decides to remediate ground water for current and reasonably expected ground water use, a decision must be made on how aggressively to remediate. The level of effort of ground water remediation can be viewed along a continuum from very aggressive (e.g., a large number of wells pumping ground water at a high rate) to natural attenuation (e.g. monitoring wells to track natural concentration decreases). For example, pumping contaminated ground water to reduce contaminant mass and to prevent spread of the contaminant plume (or reduce the size of the contaminant plume) represents an intermediate level of aggressiveness.

Based on the ground-water policy set forth in the NCP and the ground-water protection strategy, the following expectations are set forth to aid site decision makers in selection of ground water remedies.

Generally, for ground water that is currently a drinking water supply, EPA will aggressively remediate such ground water to MCL/non-zero MCLG or other risk based levels, to the extent practicable. Although the NCP preamble indicates that the appropriate timeframe must be determined through an analysis of different remedial alternatives, generally highly aggressive remediation is appropriate under these circumstances.

Where ground water resources are vital for domestic water supply but restoration is not practicable, EPA may determine that well-head treatment, rather than pumping and treating for the purpose of restoration, may be the most practicable and cost-effective means of providing protection of human health and the environment.

If ground water is not currently used as a drinking water supply but is likely to be in the future, EPA must determine the appropriate remedial time frames, which may be less aggressive than for current drinking water supplies. The time frames are established based on the likelihood of future ground water use as drinking water.

For ground water that is not currently a water supply and has a moderate chance that it will be used in the near term a limited pump and treat system to prevent plume migration and slowly reduce contaminant concentrations should be implemented. In addition to limiting migration of the ground water plume or reducing the size of the contaminant plume, reaching MCLs/non-zero MCLGs or other risk-based levels may be a secondary objective of the action. However, the action as not aggressive as the circumstances outlined above where it is more important to reach the remediation levels in a shorter timeframe.

Natural attenuation may be appropriate in certain limited circumstances. This option is appropriate only where natural processes are expected to achieve ground-water remediation levels before the ground water is expected to be needed as a drinking water source. This option is most appropriate where a source control action has been taken to eliminate or significantly control the source of contamination, for example, excavation and treatment of the source material. It is likely in such a case, that institutional controls will have to be implemented to limit exposure during the period of the action (e.g. prevent well drilling or prevent drinking water use, depending on contaminants).

Some of the factors that should be considered in determining how aggressively to remediate ground water include:

- Future demand

- o Availability of hookup to municipal water system
- o Ability to develop other alternate water supplies
- o Political feasibility of developing community water system
- o Ability of institutional controls to limit exposure
- o Lack of connections to drinking water supplies.
- o Uncertainty in determining reasonably expected use.

Future Demand: If the site is very remote from populations, it may be highly unlikely to assume heavy residential ground water use in the near term. However, in rural areas, use of ground water as drinking water for individual homes is likely to be more common than in suburban or urban areas, where municipal water systems may use surface water or at least monitor and treat their ground water preventing exposure to contaminated ground water. Furthermore, in industrial areas, it is highly unlikely that the ground water will be developed as a drinking water supply. In this case, certainly, residents will not be sinking domestic water supply wells in nonresidential areas. Consideration of future demand must be considered carefully. It is safe to consider in (but is not limited to) circumstances where land use restrictions eliminate the need for individual domestic ground water use or prevent the drilling of ground water wells.

Availability of hookup to municipal water system: It may be highly unlikely to expect residential ground water use where a site is in an area with few if any individual well users, and it is unlikely that new wells will be sunk because new water users can easily be tied in to a municipal water system which uses a water source other than the contaminated plume.

Ability to develop other alternate water supplies: Similarly, if there are feasible options other than the contaminated ground water for residential water supplies, such as surface water or ground water from deeper aquifers that are not likely to become contaminated, than use of contaminated aquifers as water supply is highly unlikely.

Jurisdictional feasibility of developing community water system: In some situation it may not be feasible to organize municipal water districts or to connect individual ground water users to a municipal or community water supply. In these cases, it may be highly unlikely to expect ground water use.

Ability of institutional controls to limit exposure: Some jurisdictions have the legal authority to impose institutional controls that effectively prevent ground water use. If ground water is contaminated, the ability of institutional controls to effectively prevent exposure may affect whether or not ground water can reasonably be expected to be used as drinking water. However, ground water must still undergo restoration pe the NCP's goal to remediate ground water to its beneficial use whenever practicable. In circumstances where institutional controls render ground water use unlikely, the remediation would occur at a less aggressive pace.

Poor water quality: Some water is inherently poor quality, containing high levels of dissolved solids resulting in taste and odor problems, as well as fouling of boilers, water heaters, and other equipment. While this water may not be "undrinkable" or meet the criteria for Class III water under EPA's ground water classification system, it may be sufficiently poor that it is unlikely to be developed as a water supply. In addition, the contaminated aquifer may not have a high enough yield to ensure a sufficient water supply. In these cases, it is highly unlikely that this ground water would be used as a water supply.

Aquifer interconnections: Some contaminated ground waters are surficial and are not connected with lower aquifers that may be of different quality or less vulnerable to contamination. If EPA can demonstrate that a surficial aquifer is not hydraulically connected to a drinking water aquifer, then a less aggressive remediation time may be appropriate.

Uncertainty in determining reasonably expected use: EPA anticipates that it will be easier to determine the reasonably expected ground water use at some sites than others, as shown from experience. The uncertainty in the reasonably expected use for a particular site may be a factor in determining how actively to remediate ground water at a site. The more uncertain, the more likely it is that EPA will determine that an aggressive approach be used.

NOTICE: The policies set out in this memorandum are intended solely as guidance. They are not intended, nor can they be relied upon, to create any rights enforceable by any party in litigation with the United States. EPA officials may decide to follow the guidance provided in this memorandum, or to act at variance with the guidance, based on an analysis of specific site circumstances. Remedy selection decisions are made and justified on a case-specific basis. The Agency also reserves the right to change this guidance at any time without public notice.

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June 3, 1991

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Re: **Dispute Resolution Under the Ormet Corporation Administrative Order By Consent Re: Remedial Investigation And Feasibility Study; U.S. EPA Docket No. V-W-87-C-013**

Dear Ms. McBride and Mr. Stewart:

Pursuant to Section XX of the above-referenced Administrative Order By Consent (the "CO") Ormet Corporation ("Ormet") is hereby invoking the dispute resolution procedures provided therein. As required by Section XX of the CO, this letter identifies the specific points of the dispute, Ormet's position regarding these points, the bases for Ormet's position and the actions Ormet considers to be necessary.

This Notice of Dispute concerns the Agencies' determination of the action-specific applicable or relevant and appropriate requirements ("ARARs") governing containment alternatives for the former spent potliner storage area (the "FSPSA"), the former disposal ponds (the "FDPs") and the construction materials scrap dump (the "CMSD"). With regard to these areas, the Agencies have improperly and arbitrarily attempted to prematurely eliminate a broad range of applicable and/or relevant remedial options from appropriate consideration in the feasibility study (the "FS"). The Agencies' premature determination of action-specific ARARs improperly circumvents the remedial alternatives development process required by Section 121(d) of the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), 42 U.S.C. § 9621(d), the National Oil and Hazardous Substances Contingency Plan (the "NCP"), 40 C.F.R. Part 300, guidance published by the United States Environmental Protection Agency ("U.S. EPA") and the CO.

Ormet has worked diligently and in good faith to accommodate the Agencies' often unrealistic and arbitrary scheduling demands throughout this process. We urge the Agencies to seriously consider the issues discussed in this letter.

A. Specific Points of Dispute

In comments on the draft alternatives report submitted in accordance with the Amended CO and during the April 10, 1991, project review meeting, the Agencies took the position that with respect to any area at the Ormet Superfund Site (the "Ormet Site" or "Site") containing cyanide, closure standards promulgated under Subtitle C of the Resource Conservation and Recovery Act ("RCRA"), 42 U.S.C. §§ 6921-6939, are the only ARARs. In making this determination, the Agencies have prematurely and inappropriately eliminated applicable and relevant requirements from the remedial alternative screening process. Moreover, RCRA Subtitle C regulations cannot be considered to be ARARs unless the requirements are both relevant and appropriate. The appropriateness of RCRA Subtitle C requirements, or any other relevant requirements for that matter, must be determined through the detailed analysis phase of the FS process. The Agencies' predetermination of remedial measures through the premature selective elimination of certain applicable and/or relevant requirements is an improper manipulation of the FS process, is inconsistent with CERCLA and the NCP, and violates the CO.

B. The Bases for Ormet's Position

1. Improper Elimination of Applicable and Relevant Requirements

The Agencies have improperly eliminated the Ohio solid waste rules, OAC Chapter 3745, and the federal solid waste rules, 40 C.F.R. Part 241, both of which are applicable and/or relevant to the conditions at the Ormet Site. The Ohio solid waste rules include closure standards for "any areas of contamination that are capped in-place per the solid waste rules." See OAC 3745-27-11 in the Ohio Administrative Code ARARs for the Ormet Site. In addition, the Agencies failed to even identify the federal solid waste rules, 40 C.F.R. Part 241, promulgated under RCRA Subtitle D as ARARs for this Site. In contrast, the Agencies have recognized at other Superfund sites located within the State of Ohio that the federal solid waste rules may well be relevant and appropriate for sites containing solid waste. The FSPSA, the FDPs and the CMSD each meet the jurisdictional prerequisites under the Ohio and federal solid waste rules and, therefore, these closure requirements along with RCRA Subtitle C requirements should be evaluated in the detailed analysis of alternatives for these three areas.

The draft alternatives report prepared by Ormet developed remedial measures consistent with the closure standards set forth in OAC 3745-27-11 and properly incorporated such measures into the site-wide alternatives assembled. Other site-wide alternatives included containment measures consistent with RCRA Subtitles C and D. In the Agencies' comments and discussions during the April 10 project review meeting the Agencies made clear their intent to pre-select regulations promulgated under RCRA Subtitle C as the containment requirements even before the detailed analysis was performed. Indeed, at the April 10 meeting, the Agencies went so far as to state that it was pointless to take any requirements other than RCRA Subtitle C requirements through the detailed analysis because the Agencies would simply reject them in the end.

The Statement of Work ("SOW") attached to and incorporated by reference in the CO and the FS Work Plan approved by the Agencies on November 14, 1990, require the development and evaluation of a full range of alternatives. Tasks 9 through 11 of the SOW address the development and evaluation of alternatives for the Ormet Site. Task 9 specifies various types of alternatives which should be developed ranging from a "no action" alternative and "alternatives which do not attain applicable and/or relevant public health or environmental standards but will reduce the likelihood of present or future threat from the hazardous substances present on site . . . [and] which closely approach[] the level of protection provided by the applicable or relevant standards" to alternatives which go beyond ARARs. The predetermination of remedial measures by eliminating alternatives which are clearly within the range specified in Task 9 directly contradicts both the language and intent of the CO.

The Agencies' pre-selection of remedial measures during the alternatives development stage of the FS process is also inconsistent with Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), and the NCP. Section 121(d) of CERCLA requires the development of remedial actions which assure protection of human health in light of the circumstances presented by site conditions. Section 300.430(e) of the NCP, 40 C.F.R. § 300.430(e), governs the development, screening and evaluation of alternatives. The NCP requires the development of a full range of remedial measures and alternatives to address the specific conditions at a site. Neither the statute nor the regulations authorize the predetermination of remedial measures through selectively developing alternatives.

During the April 10 project review meeting, the Agencies indicated that they intend to select the most stringent containment requirement available, regardless of the suitability of other less stringent requirements to the conditions at the Ormet Site. In effect, the Agencies have improperly committed to the implementation of a "top down" approach to remedy selection at this Site. This contradicts U.S. EPA's own guidance and the approach taken at other Superfund sites located within the State of Ohio.

For example, U.S. EPA's guidance document entitled "Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites" (EPA/540/p-91/001 (February, 1991)), explicitly follows a "bottom up" approach which focuses first on the least restrictive requirement applicable or relevant to the conditions at a site. The appropriateness of more stringent relevant requirements is evaluated in light of the suitability of the less stringent requirements identified. A detailed evaluation of all relevant requirements is conducted during the final stages of the FS process so that an appropriate remedy suitable to site conditions can be selected.

This bottom up approach has been followed at other Superfund sites located within the State of Ohio. For example, the records of decision published by U.S. EPA, with the State of Ohio's concurrence, for the Coshocton City Landfill and Bowers Landfill sites indicate that these landfills received hazardous substances from industrial facilities and that there were releases of such substances from the landfills into the environment. The remedial alternatives developed for these sites incorporated closure requirements under the State and federal solid waste rules which were developed and carried through the entire FS performed for each site. Although RCRA Subtitle C requirements were logically relevant to the conditions at these sites, less restrictive requirements were not eliminated. To the contrary, at both sites solid waste closure requirements were incorporated into alternatives, carried through the detailed analysis and even selected as the preferred remedy.

The FS alternatives analysis and remedy selection process under the NCP is intended to be applied consistently at all Superfund sites. The circumvention of the FS process and pre-selection of remedial measures at the Ormet Site contradicts U.S. EPA's own policies, violates the CO and is inconsistent with Section 121 of CERCLA and the NCP.

2. <u>RCRA Subtitle C Requirements as ARARs</u>

The hazardous waste regulations promulgated under RCRA Subtitle C are clearly not applicable to the Ormet Site. Indeed, the Agencies have acknowledged that RCRA Subtitle C requirements may be ARARs for the Ormet Site only because these requirements are relevant and appropriate. Section 300.5 of the NCP, 40 C.F.R. § 300.5, defines "relevant and appropriate requirements" as:

> [T]hose cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility citing laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site, addresses problems or situations sufficiently

> similar to those encountered at the CERCLA site that their use is well suited to the particular site.

The determination of whether a requirement qualifies as an ARAR because it is relevant and appropriate is a two-step process. 55 Fed. Reg. 8665, 8742 (March 8, 1990); CERCLA Compliance With Other Laws Manual (U.S. EPA, Interim Final, 1988). First, the requirement must be relevant. Relevance is based upon "a comparison between the action, location, or chemicals covered by the requirement and related conditions of the site, the release, or potential remedy." CERCLA Compliance With Other Laws Manual at pg. 1-65. Second, the requirement must be appropriate. Appropriateness is determined "by further refining the [relevance] comparison, focusing on the nature/characteristics of the substances, the characteristics of the site, the circumstances of the release, and the proposed remedial action." Id. The appropriateness evaluation is to be conducted during the detailed analysis phase of the FS process. By precluding this type of comparative evaluation as required by law, the Agencies have circumvented and undermined the integrity of the FS process.

The only indication of the rationale for the improper and premature elimination of obviously applicable and/or relevant requirements is a U.S. EPA memorandum dated March 15, 1991, from Judy Kleiman, RCRA/CERCLA Liaison, to Rhonda McBride, RPM (the "Kleiman Memo"). In this memorandum an attempt is made to establish the relevance of RCRA Subtitle C, stating:

> The spent potliners generated at this site from the primary reduction of aluminum are RCRA listed waste K088. The constituent of concern for which K088 is listed is cyanide. Contaminated soil, sediments, sludges or ground water at the site containing cyanide are assumed to contain K088 and will be subject to RCRA.

The balance of the Kleiman Memo identifies the RCRA Subtitle C capping requirements which are deemed relevant and appropriate for the FSPSA, FDPs and the CMSD.

The Kleiman Memo does not establish the relevance of RCRA Subtitle C by employing a "comparison between the action, location, or chemicals covered by the requirement and related conditions of the site, the release, or the potential remedy." Rather, the Kleiman Memo identifies cyanide as the constituent of concern for spent potliner and then blindly states that RCRA Subtitle C requirements are relevant and appropriate anywhere cyanide is found.

The NCP clearly requires a detailed analysis concerning the appropriateness of RCRA Subtitle C requirements, as well as other relevant requirements during the FS. See 40 C.F.R. § 300.400(g)(2). The following factors must be included in the appropriateness evaluation:

1. The purpose of the requirement and the purpose of the remedial action;

2. The medium regulated or affected by the requirement and the remedial action contemplated at the site;

3. The substances regulated by the requirement and the substances found at the site;

4. The actions or activities regulated by the requirement and the remedial action contemplated;

5. Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the site;

6. The type and place regulated and the type and place affected by the release or threatened release;

7. The type and size of structure or facility affected by the release or contemplated by the remedial action; and

8. Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resource at the site.

In evaluating these factors and conducting the appropriateness analysis the overall concern is whether the requirement is "well suited to the particular site." 55 Fed. Reg. 8665, 8743 (March 8, 1990). In addition, U.S. EPA's ARAR guidance document directs the decision-maker to consider "whether another requirement is available that more fully matches the circumstances at the site." CERCLA Compliance With Other Laws Manual at pg. 1-67.

If anything, the conditions at the Ormet Site indicate that RCRA Subtitle C capping requirements are inappropriate. The general toxicity and mobility of the hazardous substances detected in the FSPSA, the FDPs and the CMSD, as well as the estimated proportions of hazardous substances in the areas of concern, indicate that Subtitle C capping requirements may be overly stringent and unnecessary. The preliminary results of the Agencies' endangerment assessment did not find a pattern of release that was causing current unacceptable risks to human health or the environment. Moreover, every remedial alternative even remotely considered throughout this process, except for the no action alternative required by the NCP, provides for the continued containment and extraction of affected ground water and the construction and operation of a ground water treatment system which is in no way dependent upon reduced infiltration to effectively address ground water conditions.

U.S. EPA has acknowledged that RCRA Subtitle C capping requirements are not necessarily appropriate in situations where the areas of concern contain much lower concentrations of hazardous constituents than the material which caused the contamination. See CERCLA Compliance With Other Laws Manual at pg. 1-68. Ormet removed essentially all spent potliner from the Site by November of 1980 and the concentration of any residual contamination is extremely low compared to spent potliner. The mean concentration of total cyanide, the constituent of concern in spent potliner, detected in samples taken from the FSPSA, the FDPs and the CMSD are as follows:

Concentration in
Parts Per Million

FSPSA	FDP1	FDP2	FDP3	FDP4	FDP5	CMSD
49	89	100	24.9	40	170	14.5

In sharp contrast, spent potliner contains total cyanide concentrations ranging in the tens of thousands of parts per million. A comparison of the concentrations of all constituents found in spent potliner to the concentrations of the same constituents in the FSPSA, the FDPs and the CMSD is presented in the table attached hereto as Attachment A.[1]

The concentrations of residual spent potliner constituents present in the FSPSA, the FDPs and the CMSD are only a small fraction of the concentrations found in spent potliner. Moreover, each of these areas, with the possible exception of one defined area of relative higher concentration in the FSPSA, contain concentrations of total cyanide substantially lower than even the leachate values derived from spent potliner and referenced in the K088 background document to support the 1989 listing of spent potliner as a hazardous waste. See Listing Background Document for Spent Potliners from Primary Aluminum Reduction. Although some constituents found in spent potliner may be present in the FSPSA, the FDPs and the CMSD, the material in these areas bears only a remote resemblance to spent potliner. Under such circumstances it is certainly premature and unjustifiable to pre-select the same containment measures for these areas which would be applied to currently generated spent potliner.

In contrast, the closure standards under the Ohio solid waste rules, OAC Chapter 3745, and the federal solid waste rules, 40 C.F.R. Part 241, are particularly well-suited to address the conditions at the FSPSA, the FDPs and the CMSD, and there is no possible justification for the premature elimination of these requirements from the FS process.

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[1]Anodes used in the smelting process are formed by mixing various constituents which are then pressed into block form and baked for a period of time. Prior to undergoing the baking process, these anodes are referred to as "green anodes." During the period of time the FSPSA was used to store spent potliner, green anodes of poor quality were placed in this area. The concentrations of polynuclear aromatic hydrocarbons ("PAHs") found in the FSPSA above the concentrations typically found in spent potliner are attributable to the green anodes placed in the FSPSA.

Green anodes are not a RCRA listed hazardous waste and under the RCRA toxicity characteristic leaching procedure protocol, green anode material does not exhibit hazardous characteristics.

a. Ohio Solid Waste Rules

The closure and capping standards set forth in OAC 3745-27-11 are applicable requirements for the FSPSA, the FDPs and the CMSD because each of these areas meets the jurisdictional prerequisites of the Ohio solid waste rules. These requirements were identified by the Agencies as action-specific ARARs for the Ormet Site for "any areas of contamination that are capped in-place per the solid waste rules." See Ohio Administrative Code ARARs for the Ormet Site.

The Ohio solid waste rules represent a sophisticated set of regulations which are capable of addressing situations involving carcinogenic and other hazardous substances. OAC 3745-27-11 specifies an acceptable cap design of: (1) an impermeable soil or synthetic barrier; (2) a granular drainage layer; and (3) a soil and vegetative layer. This cap would function in a manner essentially equivalent to the double barrier cap required under RCRA Subtitle C. A single barrier cap installed according to the specifications contained in OAC 3745-27-11 would allow no greater infiltration of precipitation than would a traditional RCRA Subtitle C dual barrier cap. Any de minimis infiltration which might occur under either a single or dual barrier cap alternative would not generate sufficient quantities of liquids to percolate through the forty feet of soil beneath the FSPSA or the FDPs and thereby cause further impacts to the ground water. As with the FSPSA and the FDP, any de minimis infiltration which might occur through either a single or dual barrier cap would not cause percolation through the material in the CMSD. Moreover, the CMSD is situated on top of an impermeable (i.e., 1×10^{-7} or less) layer of silt and clay. Therefore, if infiltration were to percolate through the material in the CMSD, the leachate could be collected and disposed of properly without any risk to human health or the environment.

In all other respects, a single barrier cap would function as effectively as a dual barrier cap. Any potential risks through airborne releases, direct contact or ingestion would be eliminated by a single barrier cap and the durability of a single barrier cap would be equivalent to a dual barrier cap. In addition, all capping alternatives which have been proposed for the detailed analysis include containment of the alluvial aquifer and extraction and treatment of affected ground water.

A single barrier cap could be installed directly over the FDPs without the added step of solidification. The geotechnical properties of the solids contained in the FDPs are such that they would not be able to support a RCRA Subtitle C dual barrier cap. In order to construct a dual barrier cap over the FDPs, the pond solids would have to be solidified. Solidification of the pond solids could pose a risk to human health through the inhalation exposure pathway. This potential risk could be avoided through the use of a single barrier cap which would not require solidification of the pond solids. In addition, the time required to solidify the pond solids would be about two years and the added cost would mean that Subtitle C caps would cost approximately five times the cost associated with Ohio single barrier caps.

b. Federal Solid Waste Regulations

The RCRA regulations addressing solid waste activities, 40 C.F.R. Part 241, do not have direct applicability to individual facilities. Rather, these regulations provide guidelines and recommendations concerning standards for regulating solid waste activities. Although RCRA Subtitle D regulations are not jurisdictionally applicable to the Ormet Site, they are certainly relevant to the actions which occurred at the Site.

The RCRA Subtitle D regulations generally recommend that a soil cover "be applied as necessary in a manner to minimize fire hazards, infiltration of precipitation, odors, and blowing litter; control gas venting and vectors; discourage scavenging; and provide a pleasing appearance." 40 C.F.R. 241.209-1. Various features of the Ormet Site render this closure alternative particularly well suited to protect human health and the environment.

A natural soil cover of a few inches or more will eliminate the potential for the airborne release of particulate matter from the FSPSA and the FDPs. A natural soil cover could be installed more easily than either a single barrier cap or a dual barrier cap. This is particularly true with respect to dual barrier caps over the FDPs where implementation of a soil cover alternative would eliminate the need to solidify the pond solids and the potential risks associated with the solidification process. A natural soil cover would also provide the same degree of protection to human health and the environment as a single or dual barrier cap, provided that the aquifer beneath the Site is contained and the ground water is extracted by the interceptor wells and treated prior to discharge to the Ohio River.

Regardless of the cover installed over the FSPSA and the FDPs the alluvial aquifer beneath the facility will continue to be impacted, to some degree, by the affected media in these areas. Fluctuations in the ground water flow and the elevation of the water table will periodically cause ground water to come into contact with affected soil. This does not present a risk to human health or the environment because the alluvial aquifer beneath the Site is contained and ground water can be easily extracted by the interceptor wells and treated to a quality suitable for discharge to the Ohio River. Therefore, the elimination of infiltration will not eliminate the need for aquifer containment and ground water extraction and treatment.

The CMSD is situated on top of an impermeable (i.e., 1×10^{-7} or less) natural silt and clay layer which is on the order of forty feet thick in this area. The flow from the seep observed from the CMSD would be minimized with a properly graded soil cover and any residual flow could be effectively and efficiently addressed through collection and treatment, as necessary, prior to discharge to the Ohio River.

C. Action Requested

Ormet is an operating industrial concern with well-trained personnel. Site access restrictions can be rigidly enforced and the integrity of any cover can be monitored closely and frequently. Any disturbances to the cover could also be addressed very quickly. The existing interceptor wells and the ground water treatment system proposed for the Ormet Site and the statutory five-year review eliminate the need or justification for overly stringent remedies. Each site-wide alternative presented in the draft alternatives report, with the exception of the no action alternative required by the NCP, included containment, extraction and treatment of the contaminated plume in the alluvial aquifer beneath the Ormet Site. The existing network of monitoring wells will be utilized to monitor the aquifer and the statutory five-year review could be utilized to continually evaluate the source control mechanisms. Section 121(d) of CERCLA and the NCP require that these site-specific circumstances be considered in evaluating the appropriateness of relevant requirements.

The manipulation of the FS process and the premature determination of remedial measures is unlawful and contradicts the NCP, the CO and U.S. EPA's own guidance. Moreover, it reflects an inappropriate and myopic approach to ARAR selection and a complete failure by the Agencies to recognize that the Ormet

Site simply is not an uncontrolled abandoned CERCLA site which requires the blind application of the most stringent requirements. Rather, the Ormet Site is a well-managed operating industrial facility located in a rural and heavily industrialized area. As such, it is the type of site which is best suited to a realistic and pragmatic remedial approach.

The closure requirements set forth in OAC 3745-27-11 and the federal solid waste rules found at 40 C.F.R. Part 241 are applicable and/or relevant requirements for the FSPSA, FDPs and the CMSD. As such, these requirements must be incorporated into site-wide alternatives and taken through the detailed analysis along with RCRA Subtitle C requirements. Ormet has prepared a draft FS Report in a manner consistent with the discussion contained herein. Ormet requests the Agencies to reconsider their positions and approve as written the draft FS Report which has been submitted in accordance with the Amended CO.

Very truly yours,

John Reggi

John D. Reggi

cc: Jane Lupton, Esq.
Cynthia Hafner, Esq.
Terese Gioia
Brian Blair
E. R. Bolo, P.E.
R. S. Wiedman, Esq.

bcc: Mr. Robert L. Fargo
Mr. Cleason Smith
Mr. John E. Claypool

ATTACHMENT A

Constituent*	Spent Pickliquor Min.	Spent Pickliquor Max.	CRDA Min.	CRDA Max.	CRDA Mean	IR SPSA Min.	IR SPSA Max.	IR SPSA Mean	Scrap Dump Min.	Scrap Dump Max.	Scrap Dump Mean
Anthracene		31	0.13	3.7	1.1	<0.4	180	28.2	13	35	22.8
Benzo(a)pyrene		180	1.2	19	5.8	<0.4	710	83.9	21	200	75.6
Benzo(b)fluoranthene		310	2.8	22	8.1	<0.4	1200	129	35	390	114
Benzo(g,h,i)perylene		140	0.35	5.4	1.7	<0.4	120	22.9	4	220	34.4
Benzo(k)fluoranthene		310	2	19	6.1	<0.4	1200	100	4	50	22.5
Benzo(a)anthracene		160	1.1	16	5.3	<0.4	730	92.5	31	220	89
Chrysene		200	1.6	16	6.4	<0.4	470	72.5	25	180	83
Dibenz(a,h)anthracene		48	0.23	1.7	0.67	<0.4	220	17	5.2	41	15
Fluoranthene		240	2	14	7.4	<0.4	380	90.2	47	240	128
Indeno(1,2,3-c,d)pyrene		120	0.75	6.6	2.6	<0.4	180	28	18	160	58.4
Phenanthrene		140	0.81	9.5	4	<0.4	450	75	44	120	80
Pyrene		200	1.3	13	5.7	<0.4	820	107	43	280	135

* Concentrations in mg/kg.

Constituent*	Spent Potliner		CRDA			F SP			Scrap Dump		
	Min.	Max.	Min.	Max.	Mean	Min.	Max.	Mean	Min.	Max.	Mean
Arsenic	0.001	26	26	87	57	3	23	9.9	32.2	54.9	47.9
Barium	<0.09	200	137	309	194	33	136	63	106	125	120
Cadmium	0.01	4.9	<1.3	2	0.96	1	1.4	0.56	2	3.6	2.74
Chromium	<0.01	33	16	47	27	4.8	168	22	2.3	42.5	18.7
Lead	<0.01	44	24	85	54	7.2	74	20	54.7	83.9	70.2
Mercury	<0.0002	0.49	<0.13	0.3	0.14	0.082	0.098	0.044	<0.09	<0.12	0.05
Silver	0.01	2	<1.6	<2	0.86	1.7	11	1.4	<0.64	<0.76	0.36
Cyanide - CLP	<0.02	64000	13	254	107	1	2043	49	7.9	21.7	14.5
Cyanide	<0.02	64000	76	210	124	2.7	647	84	7.9	21.7	14.5
Fluoride	230	230000	133	323	268	0.4	1648	183	440	540	472
Aluminum	47000	222000	56500	107000	76129	2560	42500	12224	58800	121000	89400
Antimony	13	33	17	54	28	11	15	6	<3.4	<4	1.9
Beryllium	6.2	17	3.3	7.8	4.9	0.23	2.2	0.96	2.5	3.8	2.94
Cobalt	11	16	1.8	18	9.3	1.9	13	5.1	4.2	11.4	6.84
Copper	12	110	32	94	62	8	791	104	303	542	418
Magnesium	100	1700	2110	4500	3060	661	2930	1470	901	1670	1358
Manganese	0	200	131	392	272	198	3220	911	330	1060	534
Nickel	16	40	68	558	222	8.8	144	26.3	36.6	58.8	51.6
Sodium	86000	220000	7030	11500	9836	1190	12800	4477	22300	48700	32400
Thallium	<0.5	<0.5	<0.58	<0.62	0.33	0.46	0.63	0.25	<0.66	<0.78	0.36
Vanadium	75	120	36	270	139	6.1	62	19	29.4	42.4	36.5
Zinc	0.1	63	28	107	51	34	109	56	59.6	125	84.8
Calcium	3000	64000	109000	194000	151571	2.7	806	24300	8610	16100	11402

* Concentrations in mg/kg.

...tituent*	Spent Potliners Min.	Spent Potliners Max.	Pond 1 Min.	Pond 1 Max.	Pond 1 Mean	Pond 2 Min.	Pond 2 Max.	Pond 2 Mean	Pond 3 Min.	Pond 3 Max.	Pond 3 Mean	Pond 4 Min.	Pond 4 Max.	Pond 4 Mean	Pond 5 Min.	Pond 5 Max.	Pond 5 Mean	All Ponds Min.	All Ponds Max.	All Ponds Mean
...aic	0.001	26	13	64	41	20	24	22	30	123	100	57	98	65	23	66	39	13	123	48.3
...ium	<0.09	200	54	139	102	102	116	108	39	118	60	42	423	152	86	182	132	39	423	125.3
...mium	0.01	4.9	<0.88	<1.6	0.65	<1.1	<1.2	0.56	<1.4	<1.8	0.84	<1.5	<1.8	0.8	<1	2.7	0.9	<0.88	77	0.8
...mium	<0.01	33	11	59	30	6.4	18	13.8	41	119	91	34	64	52	6.4	26	14	6.4	119	29.2
l	<0.01	44	19	122	57	19	25	22	80	214	152	120	212	134	13	67	29	13	214	63.9
...cury	<0.0002	0.49	<0.088	0.31	0.15	<0.11	<0.15	0.09	<0.16	0.45	0.18	<0.14	<0.2	0.09	<0.11	0.34	0.1	<0.088	0.45	0.1
...er	0.01	2	<0.95	<1.0	0.71	<1.2	<1.3	0.63	<1.5	<1.9	0.9	<1.6	<1.9	0.9	<0.16	2.4	0.8	<0.95	2.4	0.8
...nide - CLP	<0.02	64000	46	137	89	60	137	100	<0.85	88	34.9	1.8	87	40	9	294	170	<0.85	294	122.6
...nide	<0.02	64000	32	308	155	171	263	208	<2	162	48	<2	250	101	160	896	357	<2	896	263.0
...ride	230	250000	348	1050	401	214	561	336	65	534	196	61	144	92	107	1600	657	61	1600	495.9
...minum	47000	222000	48000	68100	60133	54200	67400	59500	53800	88900	70500	48700	76800	61516	61300	105000	82792	48000	105000	74597.7
...mony	13	33	13	30	18	<6.7	11	8.3	<8.3	41	27.8	14	32	23	<6.4	88	21	<6.4	88	20.6
...llium	6.2	17	1.1	3.6	3.4	3.4	5.3	4.3	2.9	4.1	3.4	2.5	4.3	3.4	2.9	14	6.6	2.3	14	5.4
...alt	11	16	3.2	14	8.9	3.6	5.7	4.5	12	19	16	12	16	14	2	9.1	6	2	19	8.4
...er	12	110	47	101	71	70	114	91	72	130	105	35	124	82	12	57	28	12	130	52.3
...nesium	100	1700	2110	3090	2593	1310	2040	1677	1950	3330	2725	2080	4000	2677	1220	3180	2208	1220	4000	2327.8
...ganese	0	200	70	277	140	129	172	132	142	207	181	102	149	129	73	226	123	70	277	133.0
...el	16	40	62	488	224	27	59	41	199	581	406	286	656	423	19	168	70	19	656	172.2
...um	66000	220000	4760	18100	13620	6410	10500	8197	11200	16600	13550	7470	14200	10248	7500	46100	19691	6410	46100	16194.6
...ium	<0.5	<0.5	<0.41	<0.72	0.29	<0.47	<0.53	0.25	<0.59	<0.81	0.37	<0.65	<0.75	0.35	<0.46	<0.8	0.34	<0.41	<0.81	0.3
...dium	75	120	36	564	238	20	60	37	204	741	499	389	640	512	15	243	58	15	741	190.2
	0.1	63	24	32	27	16	57	40	16	75	45	23	52	37	17	170	39	16	25	38.4
...um	5000	64000	111000	319000	199667	64400	177000	99133	205000	350000	295000	267000	352000	312571	68600	208000	133513	64400	352000	182163.6

...ncentrations in mg/kg.

ound*	Spent Podimera Min.	Spent Podimera Max.	Pond 1 Min.	Pond 1 Max.	Pond 1 Mean	Pond 2 Min.	Pond 2 Max.	Pond 2 Mean	Pond 3 Min.	Pond 3 Max.	Pond 3 Mean	Pond 4 Min.	Pond 4 Max.	Pond 4 Mean	Pond 5 Min.	Pond 5 Max.	Pond 5 Mean	All Ponds Min.	All Ponds Max.	All Ponds Mean
rne		31	0.31	3.2	2	1.6	7.4	3.8	0.42	3.9	1.7	0.076	44	8.9	0.44	7.3	2.32	0.076	44	3.4
)pyrene		180	1.3	4.5	4.3	2.5	22	9.1	<0.66	6.1	2.27	<0.55	49	15	0.43	13	3.45	0.43	49	5.6
)fluoranthene		310	4.2	9.9	4.83	4.2	29	12.7	<0.66	3.6	1.77	0.22	140	47.2	0.6	16	4.55	0.22	140	11.7
,b,i)perylene		140	0.44	1.7	1.14	0.63	12	4.64	<0.66	2	0.85	<0.55	45	9.8	0.22	6	1.37	0.22	45	2.8
)fluoranthene		310	1.8	6	4.1	2.5	24	9.7	0.21	4.7	2.57	0.096	75	22.6	0.46	12	2.95	0.096	75	6.5
anthracene		160	4.4	9.2	6.6	4.1	33	14	0.84	21	7.1	0.55	100	30.1	1	17	5.42	0.55	100	10.1
e		200	7.1	10	8.3	4.3	38	13.9	1.1	22	8.4	1.4	130	48.5	0.22	17	4.86	0.22	130	13.0
,h)anthracene		48	0.17	0.45	0.34	0.21	0.6	0.5	<0.66	0.97	0.46	<0.55	11	2.8	0.061	13	0.8	0.061	13	1.0
thene		240	1.1	8.5	6	3.2	52	22	6.5	17	9.5	1.8	150	38.6	<0.47	27	7	<0.47	150	13.0
1,2,3-c,d)pyrene		120	0.64	2	1.36	0.67	15	5.7	<0.66	2.3	1	<0.55	40	9.5	0.25	6.2	1.51	0.25	40	3.0
rene		140	0.89	7.8	4.7	4.2	30	13.6	3	13	7.1	0.54	56	10.4	2	21	6.1	0.54	56	7.2
		200	6.4	9.9	8.2	4.1	37	15.6	4.7	26	10.1	1.4	55	11.7	<0.47	19	6.2	<0.47	55	8.2

ntrations in mg/kg.

ntrations in mg/kg.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: MAR 15 1991

SUBJECT: Ormet Corporation Remedial Alternatives Development

FROM: Judy Kleiman, RCRA/CERCLA Liaison Judy Kleiman

TO: Rhonda McBride, RPM

This memo is to correct my previous memo of March 13, 1991 in which I incorrectly stated that there is no RCRA waste and no RCRA ARARs at the Ormet site in Hannibal, Ohio.

The spent potliners generated at this site from the primary reduction of aluminum are RCRA listed waste K088. The constituent of concern for which K088 is listed is cyanide. Contaminated soil, sediments, sludges or ground water at the site containing cyanide are assumed to contain K088 and will be subject to RCRA. The following comments pertain to the remedial alternatives proposed here.

No action or deed restrictions and institutional controls are not sufficient corrective action and are not in compliance with RCRA requirements.

Discharged groundwater must meet MCLs as well as any NPDES standards. Activated carbon used in the treatment of seeps must be managed as K088 if it contains cyanide. In addition, the spent carbon could be characteristic by the TCLP. Spent carbon should be tested and managed accordingly.

The soils at the former spent potliner storage area (FSPSA) are heavily contaminated with cyanide and must be managed as a RCRA waste. If the contaminated soils are left in place, a RCRA cap is relevant and appropriate, along with 30 years of ground water monitoring. The design standards for a RCRA cap include 1) a low permeability layer consisting of 24" of soil with a hydraulic conductivity of 10^{-7} cm/sec and a 20 mil flexible membraine liner, 2) a drainage layer of 12" of soil or a geosynthetic layer, and 3) a vegetated cover including 24" of soil and/or topsoil. The clay/soil cap proposed in FSPSA-3 would not be in compliance with RCRA. Stabilization as proposed in FSPSA-5 cannot be used as a substitute for an appropriate cover. Soils which are treated by stabilization will still require a RCRA cap.

Since the potliners which were stored, broken and mixed with the soil in the FSPSA were disposed of prior to the effective date of RCRA, this material is not subject to the Land Ban treatment standards unless it is excavated and "placed" outside of the original area of contamination.

The former disposal ponds also contain high levels of cyanide from waste containing K088. Again, a RCRA cap is relevant and appropriate, along with 30 years of groundwater monitoring. A bentonite layer (FDP-5) would not be a sufficient cover, and the waste material cannot be used as an ingredient in the cap. Stabilization by a cement pozzolan process (FDP-7) must be combined with a RCRA cover. The system of wick drains or recontoured surfaces to promote drainage (FDP-3, FDP-4) is not a substitute for a RCRA cover.

In other areas of the site which are not specially identified with improper storage or disposal of K088, elevated levels of cyanide in the soils, sediments or sludges would be interpreted as evidence of spent potliners. RCRA ARARs would be relevant and appropriate in such cases.

In the Carbon Run-off and Depositon Area, capping is not recommended since this area is within the 100 year floodplain. We recommend that this material be removed and disposed of in a RCRA landfill off-site. This material can be consolidated with other contaminated materials on site only if it remains within the orginal area of contamination. If the contaminated material is place outside of the area of contamination, placement will occur and Land Disposal Restrictions will be triggered.

In areas which do not have elevated levels of cyanide, there is no evidence for K088 waste and RCRA ARARs will not be triggered.

Polychlorinated biphenyls, polynuclear aromatics, phthalates and phenols found here are not known to be associated with RCRA waste at this site.

If I can be of any further assistance in this matter, please contact me at 6-1482.

cc: Karl Bremer

KEMRON Environmental Services
109 Starlite Park
Marietta, Ohio 45750

Phone: (614) 373-4071

Ormet Corporation
P.O. Box 176
Hannibal. OH 43931

Attn: John Reggi/Tim Adamowicz

Purchase Order: HM00301

Order #: N4-06-028
Date: June 8, 1994 11:23
Work ID: Special Water Sampling
Date Received: 06/01/94
Date Completed: 06/08/94

Client Code: ORMET_56714

SAMPLE IDENTIFICATION

Sample Number	Sample Description	Sample Number	Sample Description
01	MW-41	02	DUP-1

All results on solids/sludges are reported "AS RECEIVED" unless otherwise specified. This report shall not be reproduced, except in full, without the written approval of KEMRON.

PRELIMINARY

Certified by
Deanna Hesson

Order # N4-06-028
June 8, 1994 11:23

KEMRON ENVIRONMENTAL SERVICES
RESULTS BY SAMPLE

This is to certify that the following samples were analyzed using good laboratory practices to show the following results.

SAMPLE ID: 01 MW-41 Collected: 06/01/94 12:00 Category: WATER

TEST DESCRIPTION	RESULT	DETECTION LIMIT	UNITS	DATE ANALYZED	BY	METHOD
Cyanide, Total	<0.01	0.01	mg/L CN	06/02/94	JWR	335.2
Fluoride	0.3	0.1	mg/L F	06/02/94	SMC	340.2
Arsenic, Dissolved	0.021	0.004	mg/L As	06/03/94	JEM	206.2/7060
Arsenic, Total	0.048	0.004	mg/L As	06/03/94	JEM	206.2/7060
Beryllium, Dissolved	<0.01	0.01	mg/L Be	06/03/94	JBC	200.7/6010
Beryllium, Total	<0.01	0.01	mg/L Be	06/03/94	JBC	200.7/6010
Manganese, Dissolved	1.2	0.01	mg/L Mn	06/03/94	JBC	200.7/6010
Manganese, Total	1.3	0.01	mg/L Mn	06/03/94	JBC	200.7/6010
Vanadium, Dissolved	<0.01	0.01	mg/L V	06/03/94	JBC	200.7/6010
Vanadium, Total	<0.01	0.01	mg/L V	06/03/94	JBC	200.7/6010

SAMPLE ID: 02 DUP-1 Collected: 06/01/94 Category: WATER

TEST DESCRIPTION	RESULT	DETECTION LIMIT	UNITS	DATE ANALYZED	BY	METHOD
Cyanide, Total	<0.01	0.01	mg/L CN	06/02/94	JWR	335.2
Fluoride	0.3	0.1	mg/L F	06/02/94	SMC	340.2
Arsenic, Dissolved	0.021	0.004	mg/L As	06/03/94	JEM	206.2/7060
Arsenic, Total	0.057	0.004	mg/L As	06/03/94	JEM	206.2/7060
Beryllium, Dissolved	<0.01	0.01	mg/L Be	06/03/94	JBC	200.7/6010
Beryllium, Total	<0.01	0.01	mg/L Be	06/03/94	JBC	200.7/6010
Manganese, Dissolved	1.2	0.01	mg/L Mn	06/03/94	JBC	200.7/6010
Manganese, Total	1.5	0.01	mg/L Mn	06/03/94	JBC	200.7/6010
Vanadium, Dissolved	<0.01	0.01	mg/L V	06/03/94	JBC	200.7/6010
Vanadium, Total	<0.01	0.01	mg/L V	06/03/94	JBC	200.7/6010

DE91-014969

ORNL/TM-11866

ornl

OAK RIDGE
NATIONAL
LABORATORY

MARTIN MARIETTA

The Effectiveness of Groundwater Pumping as a Restoration Technology

C. B. Doty
C. C. Travis

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

ORNL/TM-11866

THE EFFECTIVENESS OF GROUNDWATER PUMPING AS A RESTORATION TECHNOLOGY

C. B. Doty
C. C. Travis

Date Published - May 1991

**Prepared by the
Risk Analysis Section
Health and Safety Research Division
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EXECUTIVE SUMMARY

An in-depth analysis of the effectiveness of pumping groundwater for aquifer restoration was conducted based on: (1) performance records for 16 sites where pumping with the objective of aquifer restoration has been implemented for periods of 2 to 12 years, and (2) recent theoretical and modeling studies. The reduction of aquifer concentrations is the primary indicator of effectiveness of groundwater extraction. However, other indicators of effectiveness such as plume containment, mass reduction, and achievement of specific cleanup goals are also components of the evaluation.

At the sites reviewed, the pump and treat systems appear to be effective for containing the contaminant plume, and for reducing the mass of contamination in the aquifer. However, groundwater extraction systems are not effective for aquifer restoration. Data indicate that pumping can achieve concentration reductions of 90% to 99% prior to leveling at sites with high initial concentrations (greater than 1,000 ppb). However, concentrations at these sites remain significantly above health-based levels, and significant masses of contamination remain in the aquifers. At sites with initial concentrations less than 1,000 ppb, concentration reductions of 90% or less are achieved prior to leveling. Once leveling occurs, further significant reduction cannot be accomplished within a reasonable time frame. Even though concentrations may level at relatively low concentrations, when pumps are turned off, the concentrations tend to rise again.

The evidence to date suggests that the primary contributors to the ineffectiveness of pumping for aquifer restoration are phenomena resulting from physical and chemical processes that affect the behavior of contaminants in the subsurface environment. Recent studies show that soils long-contaminated with halogenated organic compounds are resistant to desorption, and the rate of contaminant desorption is controlled by diffusion of contaminants from within soil particles. Non-aqueous phase liquids (NAPLs) that either float on top of the water table or sink to the bottom of the aquifer cannot be effectively mobilized by pumping because they are immiscible in water.

Most aquifers are heterogeneous and have low permeability zones where contaminants become immobilized. Pumping causes preferential flow of groundwater in zones of high permeability, resulting in the trapping of even highly soluble contaminants in low permeability zones. The mass of immobilized contaminants in the subsurface is generally significantly greater than the mass dissolved in the groundwater, and the extraction of all the immobile contaminants is not technically feasible at the present time.

Groundwater modeling had been conducted at two-thirds of the sites reviewed. The models used over-simplified generic assumptions and did not account for the tailing effect observed at the sites. Remedial time frames of 2 years to 30 years were predicted at the sites reviewed. However, recent modeling studies suggest that pumping and treating will not restore aquifers to drinking water standards within these time frames. Pump and treat time frames of 100 years may be needed to lower concentrations by a factor of 100, assuming the ideal conditions of a homogeneous aquifer. For water-insoluble constituents such as jet fuel, thousands of years may be needed to remove the contaminants.

Based on our review of performance records and recent theoretical studies, the following can be concluded regarding the use of groundwater pumping for aquifer restoration:

- Pumping is effective for contaminant mass reduction, plume containment, and extraction of groundwater for point-of-use treatment. Its use for attaining these objectives should be encouraged.

- Groundwater pumping is ineffective for restoring aquifers to health-based levels. This reality needs to be explicitly recognized by regulators.

- The primary contributors to the ineffectiveness of pumping in meeting cleanup goals are the time-dependent decrease in the rate of desorption of contaminants from contaminated soils and the existence of immobile contaminants either in the non-aqueous phase or trapped in zones of low permeability.

- Remedial time frames of 2 years to 30 years were predicted at the sites reviewed. Regulators currently maintain that 20 to 40 years may be needed to reach health-based cleanup goals. However, recent modeling studies estimate pump and treat time frames of 100 to 1,000 years.

1.0 INTRODUCTION

During the past decade, the U. S. has passed legislation to address the remediation of inactive hazardous waste sites. The original emphasis of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) was on short-term remedies. However, with the passing of the Superfund Amendments and Reauthorization Act of 1986 (SARA), the philosophy of the program shifted toward long-term solutions to addressing contamination. The new program required that remedial alternatives be "protective of public health and the environment" and "significantly and permanently" reduce the toxicity, mobility, or volume of contaminants. The shift toward seeking permanent solutions occurred, however, before proven technologies were available for permanent remediation of sites.

Although post-SARA remedial action decisions reflect an increase in the selection of treatment remedies, most of these decisions have been made based on weak rationales regarding the effectiveness of the remedies selected. Treatment remedies may, in theory, provide permanent risk reduction; however, the selection of a treatment approach does not necessarily ensure the effectiveness and permanence of a remedy. Now that performance records are becoming available for remedial actions involving treatment technologies, a need exists for more research to evaluate the effectiveness of this approach. One such treatment approach is pumping and treating groundwater with the remedial objective of restoring contaminated aquifers.

1.1 Aquifer Restoration and the Decision Process

CERCLA remedial action decisions addressing groundwater contamination through fiscal year 1985 primarily consisted of containment of the contaminant plume or provision of an interim drinking water supply. Only 14% of the decisions addressed aquifer restoration (Haiges and Knox 1987). The average cleanup time predicted in these decisions was one to five years, although the cleanup times were subject to extension because toxicological data were lacking for many of the priority pollutants and cleanup standards were often not available. The feasibility of aquifer restoration using groundwater pumping and treating was assumed based on limited theoretical, laboratory, and field studies.

However, the number of decisions selecting aquifer restoration as a remedial objective increased during fiscal year 1986, and approximately 68% of remedial action decisions addressing groundwater contamination during fiscal year 1987 involved aquifer restoration (Doty and Travis 1989). Quantitative cleanup goals were established for all of these sites based on applicable or relevant and appropriate requirements (ARARs) or health-based goals derived from site-specific risk assessments. This trend reflects both the change in program philosophy and the progress made in the field of risk assessment. Although more quantitative toxicological data were available, thus facilitating the establishment of health-based cleanup goals for ground water, the effectiveness of the pump and treat approach to achieving aquifer restoration to these levels was no more certain than in earlier decisions.

In the 1987 decisions, rationales for predicting the effectiveness of pumping and treating to restore aquifers to the cleanup levels established in the RODs were not well-supported. The effectiveness of pumping groundwater to restore aquifers was questionable at these sites for one or more of the following reasons:

1. Effectiveness and permanence of the source remedy selected was uncertain.
2. Extent of groundwater contamination had not been confirmed, and additional studies were needed.
3. Contributing sources of contamination had not been determined or fully characterized.
4. Further studies were needed to determine applicability of technology to site conditions.
5. Hydrogeological uncertainties were associated with pumping and treating.

Since the passage of SARA, hundreds of decisions have been made to restore aquifers using the pump and treat method. Although decision-makers have acknowledged that pumping and treating groundwater is a time-consuming and often unpredictable process, this method has essentially been the only available option for aquifer restoration in some cases. More recent studies and field experience (EPA 1989) indicate, however, that aquifer restoration is not as feasible as was previously predicted in remedial action decisions.

1.2 Purpose

The purpose of this project is to provide an in-depth analysis of the effectiveness of pumping groundwater for aquifer restoration based on recent performance records and theoretical studies. Although laboratory, field, and modeling studies have been conducted regarding the feasibility of aquifer restoration using the pump and treat approach, little performance data have been available until recently. In 1989, the Environmental Protection Agency (EPA) conducted a study of 19 sites where pump and treat operations had been implemented for up to six years. The present study differs from the EPA study in two ways. First, we analyze performance records at sites where the pump and treat system was designed specifically for restoration of the aquifers to drinking water standards or to a specified negotiated cleanup goal. Unlike the EPA study, we include no sites where remediation was designed exclusively for containment or wellhead treatment. Second, we update and expand upon EPA's performance record data base.

1.3 Approach

The effectiveness of groundwater pumping and treating as a remedial alternative for aquifer restoration was evaluated by reviewing: (1) performance records for 16 sites where pumping and treating has been implemented for more than one year, and (2) recent theoretical and field studies. Sites selected for evaluation consist of both Superfund and non-Superfund sites where the pump and treat system was designed for restoration. Site descriptions and results for the pump and treat operations reviewed are presented in Appendices A and B. Pertinent literature, performance records, and support documents were reviewed. Existing databases were used, and interviews with regional EPA personnel and/or contractors were conducted to identify sites for evaluation and to obtain necessary data.

The effectiveness of groundwater pumping is typically evaluated in one or more of the following ways: (1) reduction in aquifer concentrations over time; (2) containment of the contaminant plume; (3) reduction of contaminant mass in aquifer; (4) comparison of contaminant mass removed to estimated mass of contaminants lost to the environment; and (5) comparison of aquifer concentrations to specific cleanup goals established.

Because proven technologies are available for treating most hazardous constituents in water to meet drinking water standards once the contaminated water is pumped from the subsurface, the focus of the present evaluation is on the effectiveness of pumping as a method for removing contaminants from the subsurface. The ability of pumping to reduce aquifer concentrations is the primary indicator of effectiveness in the present evaluation. However, the following factors are also components of the analysis: (1) the effectiveness of the system in containing the migration of aquifer contaminants; (2) the effectiveness of the system in reducing contaminant mass over time; (3) the success or failure of modeling in predicting the effectiveness and time frame associated with the approach; (4) the feasibility of attaining established cleanup goals; and (5) factors which influence effectiveness.

The present evaluation of groundwater extraction remedies was limited by the following factors: (1) the small number of sites where pumping has been ongoing for more than one year; (2) the extent of the site investigation on which the remedial design is based; and (3) the protocol used to measure and report the effectiveness of the remedy. Most pump and treat operations have not operated more than two or three years. However, for most systems, patterns in aquifer concentration reduction are evident after a year or two, and these patterns can be considered in light of recent research to predict future pump and treat performance at the sites.

Inconsistencies existed with respect to the availability of data and the ways in which remediation results were reported. Initial concentrations were frequently available for all the primary contaminants, while resulting aquifer concentrations were often reported only in terms of average VOC air stripper influent concentrations. These average concentrations may not be representative of maximum concentrations present in some wells at the sites.

2.0 PUMP AND TREAT SYSTEMS

The sites reviewed and the length of operation to date for the sites are listed in Box 1. Performance records were not available for the entire duration of the operation for some sites. The performance records reviewed range from 2 to 12 years and are limited to those reported in the documents listed in Appendix B. A brief review of the site performance records follows. Additional site descriptions and results for the pump and treat operations reviewed are presented in Appendices A and B.

Box 1 - Performance Records Reviewed

Site	Length of Operation
Amphenol Corporation, NY	3 years
Des Moines TCE, IA	2.5 years
General Mills, MN	4 years
GenRad Corporation, MA	3 years
Harris Corporation, FL	6.5 years
IBM Dayton, NJ	13 years*
IBM San Jose, CA	8 years
Nichols Engineering, NJ	2.5 years
Ponders Corner, WA	6 years
Savannah River, SC	5 years
Sharpe Army Depot, CA	2.5 years
Sylvester, NH	4 years
Twin Cities AAP, MN	2 years
United Chrome, OR	2 years
Verona Wellfield, MI	6.5 years
Wurtsmith AFB, MI	13 years

* Operation ceased for four years during this period.

Amphenol Corporation, NY

LOCATION:	Sidney, NY
TYPE OF SITE:	Electrical connector manufacturing facility (non-NPL)
CONTAMINANTS:	TCE, Chloroform
GEOLOGY:	A 100 to 200 foot thick layer of alluvial materials is underlain by glaciofluvial sands and gravels.

The Amphenol Corporation pump and treat operation is a small system consisting of only two extraction wells. Before the removal of the contaminated soil at the site, initial maximum VOC concentrations were 230 ppb. However, when the pump and treat operation began in 1987, maximum concentrations had declined to 150 ppb. One shallow aquifer extraction well and one deep aquifer extraction well are in operation with a total pumping rate of 200 gpm. Seventeen monitoring wells were initially installed, but some have been discontinued. The system has operated for 3 years. Concentrations began to level off at 50 ppb in 1988.

Des Moines TCE, IA

LOCATION:	Des Moines, IA
TYPE OF SITE:	Municipal wellfield (NPL)
CONTAMINANTS:	TCE, T-1,2-DCE, and vinyl chloride
GEOLOGY:	The area is underlain by a layer of silt and clay and a layer of unconsolidated sand and gravel. These layers are underlain by consolidated shale, siltstone, and sandstone. Below this system lies consolidated dolomite, limestone, sandstone, and shale formations. Three primary aquifer systems are associated with the site, two of which are important sources of drinking water in the area.

An estimated 200 gallons of contaminants were reportedly lost to the soils and groundwater at the Des Moines TCE site. The groundwater is contaminated with TCE, with initial TCE concentrations of approximately 8,500 ppb. Seven recovery wells were initially installed with a total pumping rate of 1,300 gpm. Six of these wells are still in operation at a pumping rate of 1,000 gpm. Pumping for 2.5 years has resulted in the extraction of more than 1,500 gallons of contaminants. However, concentrations have leveled off at between 500 ppb and 1,000 ppb. An additional source of contamination is being investigated.

General Mills, MN

LOCATION:	Minneapolis, MN
TYPE OF SITE:	Food research laboratory (non-NPL)
CONTAMINANTS:	TCE, TCA, PCE
GEOLOGY:	Thirty to fifty feet of unconsolidated alluvial and glacial deposits are underlain by a sequence of fractured sandstone, shale, dolomite, and limestone.

TCE is the primary groundwater contaminant with initial maximum concentrations of 1,300 ppb in the shallow aquifer and lower (Carimona) aquifer concentrations of 2,300 ppb. Five shallow aquifer extraction wells and one extraction well in the Carimona aquifer are in operation. Pumping at 300 gpm in the shallow aquifer and 50 gpm in the Carimona aquifer has resulted in substantial reduction of TCE concentrations. However, aquifer concentrations remain above target levels and remain as high as 460 ppb in one area.

Genrad Corporation, MA

LOCATION:	Bolton, MA
TYPE OF SITE:	Scientific and medical equipment mfg.
CONTAMINANTS:	TCE
GEOLOGY:	Unconsolidated glacial deposits overlie metamorphic rocks. In low-lying areas, organic sediments overlie sands and gravels. Depth to groundwater is generally only five feet.

Although two plumes, the eastern plume and the northern plume, are present at the site, only the eastern plume is addressed by the present system. Initial VOC concentrations were 1,000 ppb and TCE concentrations were 270 ppb. Two extraction wells have been in operation for three years in the eastern plume area at a pumping rate of 30 gpm. Sixteen monitoring wells are also in operation. TCE concentrations began to level in 1988 at approximately 100 ppb.

Harris Corporation, FL

LOCATION:	Palm Bay, FL
TYPE OF SITE:	Manufacturing facility (NPL)
CONTAMINANTS:	TCE, TCEA, vinyl chloride, methylene chloride, chlorobenzene, xylene, and ethylbenzene
GEOLOGY:	The upper sand aquifer, which is an unconfined aquifer, is used locally as a water source. Below the upper aquifer is a 22-foot thick sandy clay layer that acts as a leaky aquitard, retarding groundwater flow between the upper aquifer and the 30-foot thick unconsolidated lower sand aquifer. Underlying the lower sand aquifer is the Hawthorne formation, a clay confining layer up to 200 feet thick. The fifth layer is the Floridan aquifer, a 1,000-foot thick sequence of limestone and dolomite.

Groundwater at the site is contaminated with VOCs at a maximum initial concentration of 10,000 ppb. The pump and treat system has been operating for 6.5 years. The current system consists of 11 extraction wells, four of which are deep aquifer barrier wells. The remaining wells recover groundwater from both the shallow and deep aquifers. The pumping rate has remained constant since startup at 300 gpm.

Although the average treatment system influent VOC concentrations have declined and leveled at approximately 500 ppb, concentrations remain above 1,000 ppb in one shallow extraction well, two deep aquifer extraction wells, and one deep aquifer monitoring well. In one of the temporary onsite shallow monitoring wells installed in 1987, VOC concentrations fluctuated between 1 and 30,000 ppb during 1988 and 1989 and remained at 14,000 ppb during 1989. This contamination has been attributed almost exclusively to xylene and ethyl benzene, as opposed to TCE, DCEA, and vinyl chloride in the extraction wells (Harris Corporation 1990).

IBM Dayton, NJ

LOCATION:	South Brunswick, NJ
TYPE OF SITE:	Electronics manufacturing facility (non-NPL)
CONTAMINANTS:	1,1,1-TCA and PCE
GEOLOGY:	The shallow unconfined aquifer is comprised of the two upper geologic units which consist primarily of clay, silt, and gravel. These units are underlain by a thin discontinuous clay layer. The lower semi-confined aquifer consists of a sand and gravel unit underlain by relatively impermeable shale.

The site was contaminated with approximately 400 gallons of VOCs, primarily 1,1,1-trichloroethane (TCA) and tetrachloroethylene (PCE), with maximum ground water concentrations ranging from 9,590 ppb for TCA to 6,132 ppb for PCE. The initial system installed in 1978 consisted of 13 shallow aquifer extraction wells, one deep aquifer extraction well, one offsite production well, and 100 monitoring wells. The average pumping rate was 300 gpm with a maximum pumping rate at the offsite well of 500-600 gpm. Pumping between 1978 and 1984 lowered VOC concentrations to below 100 ppb. However, subsequent to shutdown of the operation in 1984, PCE concentrations rose to 13,558 ppb in 1988. Pumping was resumed in 1989, but the remedial objective was changed from restoration to containment.

IBM San Jose, CA

LOCATION:	San Jose, CA
TYPE OF SITE:	Electronics manufacturing facility (Non-NPL)
CONTAMINANTS:	Freon 113, TCA, 1,1-DCE, and TCE
GEOLOGY:	The valley floor is underlain by a sequence of alternating sand and gravel layers separated by silt and clay layers. Bedrock in the area consists of consolidated sandstones, shales, cherts, serpentinite, and ultrabasic rocks. Contamination is distributed throughout five aquifers at the site.

The IBM San Jose site is contaminated with freon, TCA, 1,1-DCE, and TCE. Although the site involves relatively low-level contamination, the distribution of contaminants throughout several geologic layers is complex, and contaminants have migrated more than two miles offsite. Initial maximum concentrations of TCE, the primary contaminant of concern, were 100 ppb in the B aquifer, where an action level was set at 50 ppb. Although more than 8,000 lbs. of contaminants have been extracted, and B aquifer concentrations have declined to 50 ppb, contamination leaking from the A aquifer acts as a continued source of contamination. Pumping has caused dewatering of the shallow aquifer, and therefore, pumping in the A aquifer has been reduced to a minimum. Pumping continues in areas with concentrations of less than 50 ppb, but no change in concentrations has been observed.

Nichols Engineering, NJ

LOCATION:	Hillsborough, NJ
TYPE OF SITE:	Combustion research facility (non-NPL)
CONTAMINANTS:	Carbon tetrachloride, PCE, chloroform
GEOLOGY:	Silty soil overlies fractured shales, siltstone, and sandstones.

The primary contaminant at the Nichols Engineering site is carbon tetrachloride, with maximum initial concentrations of 980 ppb. One recovery well was installed initially with a pumping rate of 65 gpm. Two more extraction wells were installed in 1989 with a pumping rate of 70 gpm. Although 80% to 90% reductions of concentrations have been observed in some wells, average carbon tetrachloride concentrations have leveled at between 100 and 200 ppb and have remained unchanged in one well.

Ponders Corner, WA

LOCATION:	Pierce County, WA
TYPE OF SITE:	Dry cleaning facility (NPL)
CONTAMINANTS:	PCE; TCE; 1,2-trans-DCE
GEOLOGY:	The uppermost geologic unit, the Steilacoom gravel unit, is generally unsaturated but has some perched saturated zones. The underlying Vashton Till, a semi-confining layer that has discontinuous saturated zones, is composed of silts and clays with sand and gravel lenses. The third geologic unit, the Advance Outwash unit, is the primary aquifer in the area. This unit is from to 20 to 90 feet thick and lies at depths of 25 to 84 feet below the land surface. The Colvos unit underlies the Advance Outwash aquifer. This fine sand aquifer is less permeable than the Advance Outwash aquifer and may help prevent migration to deeper units.

Groundwater at the Ponders Corner site is contaminated with an estimated 1,500 lbs. of contaminants, primarily PCE, with initial maximum concentrations of 500 ppb. Two extraction wells are in operation with a total pumping rate of 2,000 gpm. Forty-two monitoring wells were originally installed, but some of these wells have been discontinued recently. The pump and treat system has been operating for 6 years. However, a portion of the plume is not being captured by the system, and PCE concentrations have leveled between 50 and 100 ppb. PCE concentrations remain persistent in the well closest to the source and in wells with low concentrations. It is estimated that 90 percent of contaminants are contained in low permeability zones.

Savannah River Plant, SC

LOCATION:	Aiken, SC
TYPE OF SITE:	Department of Energy research and weapons manufacturing facility (NPL)
CONTAMINANTS:	TCE, PCE
GEOLOGY:	Permeable and impermeable layers: sands, silts, and clays with a water table 60 to 120 feet below the land surface.

One of the most highly contaminated sites reviewed is the Savannah River Plant in South Carolina. Permeable and impermeable layers were contaminated with solvents, with initial TCE concentrations as high as 250,000 ppb. The estimated volume of contaminated groundwater is 182 million gallons.

The pump and treat system consists of 11 recovery wells with a total pumping rate of 400 gpm and 236 monitoring wells. Although maximum concentrations have been reduced by as much as

86%, and more than 193,000 lbs. of contaminants have been extracted, no significant reductions in the average concentrations and the size of the plume have been observed after 5 years of pumping. Average VOC concentrations have leveled at approximately 40,000 ppb. The plume is not captured and has migrated into a deeper aquifer. The system is being re-designed and the objective of the pump and treat operation has been changed from restoration to containment and mass reduction.

Sharpe Army Depot, CA

LOCATION:	Lathrop, CA
TYPE OF SITE:	Army vehicle maintenance
CONTAMINANTS:	TCE
GEOLOGY:	Underlain by a complex sequence of interbedded sand, silt, and clay.

Permeable and impermeable layers are contaminated with TCE at average initial concentrations of 290 ppb. The original goal of the system was to prevent off-site migration of the plume. However, the objective of the remediation was subsequently changed to restoration. The present system consists of 15 extraction wells with a total pumping rate of 200 gpm. Early results were promising, and the system has been successful in preventing migration of the plume. However, after pumping for 2.5 years, concentrations have leveled at approximately 100 ppb, and concentrations in the lower aquifer are not meeting expectations.

Sylvester, NH

LOCATION:	Nashua, NH
TYPE OF SITE:	Hazardous waste dump
CONTAMINANTS:	Tetrahydrofuran, toluene, TCE
GEOLOGY:	Silt, sands, and interbedded sediments overlying fractured rock.

More than 800,000 gallons of hazardous wastes were disposed of at the Sylvester site. Groundwater at the site is highly contaminated, with the following initial maximum concentrations: 1,500,000 ppb tetrahydrofuran, 29,000 ppb toluene, and 15,000 ppb TCE. A 3-foot slurry wall was constructed around the 20-acre site, and Alternate Concentration Limits (ACLs) were established for the contained groundwater. The pump and treat system, which consists of eight extraction wells with a total pumping rate of 300 gpm, has been in operation for 4 years. Therefore, the two-year time frame projected for reaching ACLs within the contained area has already been exceeded by two years. Average THF concentrations remain at 15,000 ppb, average toluene concentrations are 50,000 ppb, and average TCE concentrations are 3,000 ppb. These contaminant levels are significantly above the established the ACLs.

Twin Cities AAP, MN

LOCATION:	New Brighton, MN
TYPE OF SITE:	Ammunition production (NPL)
CONTAMINANTS:	TCE
GEOLOGY:	Organic soils, sands, and clays are underlain by cohesive and relatively impervious till. The third unit consists of glacial outwash and/or valley fill materials 100 to 350 feet below the land surface. This unit is underlain by a bedrock unit consisting of weathered and fractured dolomite overlying sandstone. Little hydraulic separation exists between the overburden and bedrock units.

Groundwater is contaminated with TCE, with initial maximum outwash aquifer concentrations of 20,000 ppb and bedrock concentrations of 100 ppb. The pump and treat system has been in operation for two years. The system originally consisted of six boundary extraction wells; however, three months later, more wells were added to the system. Currently, 12 boundary wells and 5 wells downgradient of interior source areas are operating at a total pumping rate of 2,700 gpm. The plume has been captured by the system, and more than 21,000 lbs. of VOCs have been extracted to date. However, maximum TCE concentrations remain as high as 18,000 ppb, and average VOC influent concentrations remain unchanged at approximately 1,000 ppb.

United Chrome, OR

LOCATION:	Corvallis, OR
TYPE OF SITE:	Chrome plating facility (NPL)
CONTAMINANTS:	Chromium (hexavalent)
GEOLOGY:	Upper unconfined zone consists of clayey silt alluvium with a saturated thickness of 15 to 18 feet during winter and decreasing during the summer; during winter, saturated zone often reaches the ground surface. Lower confined aquifer ranges from 29 to 45 feet below the ground surface.

Both shallow and deep aquifers are contaminated with hexavalent chromium with maximum concentrations of 6,860 ppm and average concentrations of 1,923 ppm. The system currently consists of 23 upper zone and 7 lower aquifer extraction wells with a total pumping rate of 17 gpm. Average groundwater concentrations have declined steadily since the beginning of the operation. However, although the average concentration was 576 ppm at the end of 1989 and a total of 13,376 lbs of chromium had been removed, concentrations have either increased or remained constant in many of the upper zone wells. Highly contaminated soils still serve as a major source of contamination at the site. A more extensive characterization of deep aquifer has been recently conducted.

Verona Wellfield, MI

LOCATION:	Battle Creek, MI
TYPE OF SITE:	Municipal wellfield (NPL)
CONTAMINANTS:	1,1-DCA; 1,2-DCA; 1,1,1-TCA; 1,2-DCE; 1,1-DCE; TCE; and PCE
GEOLOGY:	Sand and gravel aquifer overlies an upper sandstone aquifer with clay lenses, a confining siltstone bed, a lower sandstone aquifer, and a layer of shale; sandstone contains extensive horizontal and vertical fracturing.

Groundwater at the Verona Wellfield site was contaminated with an estimated 3,900 lbs. of contaminants, with VOC maximum concentrations of 19,000 ppb. A pump and treat system has been operating for 6.5 years, and a vapor extraction system has been operating for 2.5 years. The pump and treat system consists of five barrier wells and nine groundwater extraction wells screened in the water-table aquifer with a total pumping rate of 400 gpm. A vapor extraction system has also been installed. More than 10,000 lbs of contaminants have been removed from the groundwater, and 40,000 lbs have been removed from the soil.

The efficiency of the pump and treat system has increased since installation of the vacuum extraction system. However, average total VOC concentrations remain at approximately 2,500 ppb. According to modeling conducted at the site, concentrations of 100 ppb were expected after 3 years of operation.

Wurtsmith AFB, MI

LOCATION:	Wurtsmith, MI
TYPE OF SITE:	Underground storage tank (non-NPL)
CONTAMINANTS:	TCE, DCE
GEOLOGY:	A sand and gravel unit is underlain by a clay unit at approximately 62 feet below the land surface. Clay beds exist in the sand and gravel unit in the northern part of the site at depths of 5 to 15 feet below the land surface. The clay unit separates the aquifer from the underlying bedrock.

Groundwater is contaminated with both TCE and trans-1,2-dichloroethene, primarily TCE. Two separate plumes exist at the site. Initial average TCE concentrations in the Arrow Street area were approximately 18,000 ppb in 1978 when a two-well system began operation, pumping water into an aeration reservoir. In 1982, the Arrow Street Purge Well System was installed with a pumping rate of 1200 gpm. Concentrations in this area have been reduced to approximately 70 ppb over a period of 12 years. The Mission Street system, a separate system installed in 1988, consists of five extraction wells at a pumping rate of 220 gpm. Concentrations in this area have been reduced from 800 ppb to between 500 and 700 ppb after two years of pumping.

3.0 INDICATORS OF PUMP AND TREAT EFFECTIVENESS

3.1 Reduction of Aquifer Concentrations Over Time

The reduction of aquifer concentrations over time is the primary indicator of the effectiveness of a pump and treat system in restoring an aquifer to a specified cleanup level. The ideal scenario would be a steady decrease in contaminant concentrations until the target level is attained. However, performance records have suggested that although concentrations may drop initially, this decline is followed by a leveling of concentrations with little or no further decrease in concentrations (EPA 1989).

For the purpose of characterizing concentration leveling patterns, we examined the relationship between initial concentration and leveling concentration for sites where concentrations have declined sharply and remained constant for periods of six months to several years (Table 1). These sites have performance records of 2 to 12 years and initial concentrations ranging from 5 ppb to 250,000 ppb. The analysis is based on the comparison of both maximum and average initial concentrations to the average concentrations at which leveling occurred. This approach may overestimate the reduction of maximum concentrations but provides a reasonable basis for comparison to average concentration reductions.

Table 1

Leveling of VOC Concentrations

Site	Contaminant	Initial Concentration*	Concentration Leveling (ave.)	Reduction Prior to Leveling
Wurtsmith AFB, MI	TCE	29,300 (max.) 4,000 (ave.)	400	99% 90%
IBM Dayton, NJ	VOCs	15,700 (max.) 300 (ave.)	100	99% 67%
	TCA	9,600 (max.) 200 (ave.)	50	99% 75%
	PCE	6,132 (max.) 100 (ave.)	50	99% 50%
Savannah River, SC	VOCs	400,000 (max.) 46,500 (ave.)	35,000	91% 25%
	TCE	250,000 (max.) 32,500 (ave.)	25,000	90% 23%
	PCE	150,000 (max.) 14,000 (ave.)	10,000	93% 29%
Verona Wellfield, MI	VOCs	100,000 (max.) 19,000 (ave.)	2,900	97% 85%
Harris Corporation, FL	VOCs	10,000 (max.) 3,786 (ave.)	500	95% 87%
Des Moines TCE, IA	VOCs	10,562 (max.)	740	93%
	TCE	8,467 (max.)	650	92%
	T-1,DCE	2,000 (max.)	90	96%
General Mills, MN	TCE	2,300 (max.)	300	87%
Nichols Engineering, NJ	CCl_4	980 (max.)	150	85%
Gearad, MA	TCE	990 (max.)	150	85%
Sharpe Army Dep., CA	TCE	900 (max.) 290 (ave.)	100	89% 66%
Ponders Corner, WA	VOCs	400 (max.) 280 (ave.)	50	88% 82%
	PCE	370 (max.) 270 (ave.)	50	86% 81%
Amphenol, NY	VOCs	150 (max.) 85 (ave.)	35	77% 59%
IBM San Jose, CA	VOCs	175 (max.)	90	49%
	TCA	100 (max.)	50	50%
	Freon 113	70 (max.)	35	50%
	1,1-DCE	5 (max.)	5	0%

* Concentrations in ppb

Savannah River, SC

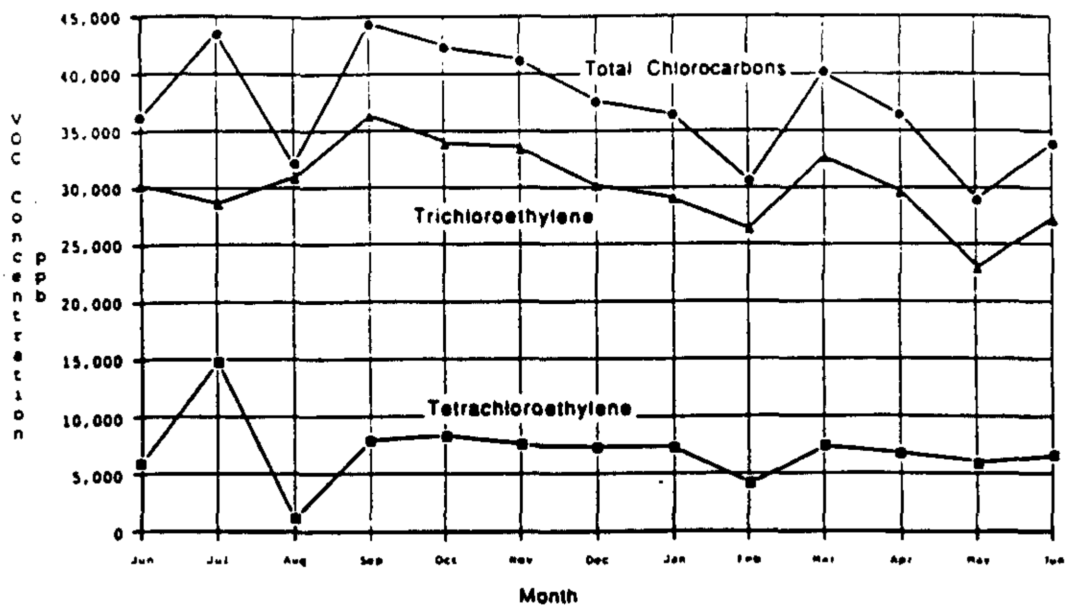
The Savannah River performance record provides an example of a site where concentrations have leveled at high concentrations. The Savannah River site is contaminated with VOCs, with initial concentrations as high as 400,000 ppb. The pump and treat operation has been in operation for five years at the site. After approximately two years of pumping, VOC concentrations leveled at 35,000 ppb (Figure 1), with a maximum concentration reduction of 91% and a reduction of average concentrations by only 25% prior to leveling (Table 1). No significant change in average concentrations has been observed since the concentrations leveled in 1987. The unusually low rate of average concentration reduction prior to leveling can be attributed to the low pumping rate (400 gpm) at the site.

Wurtsmith AFB, MI

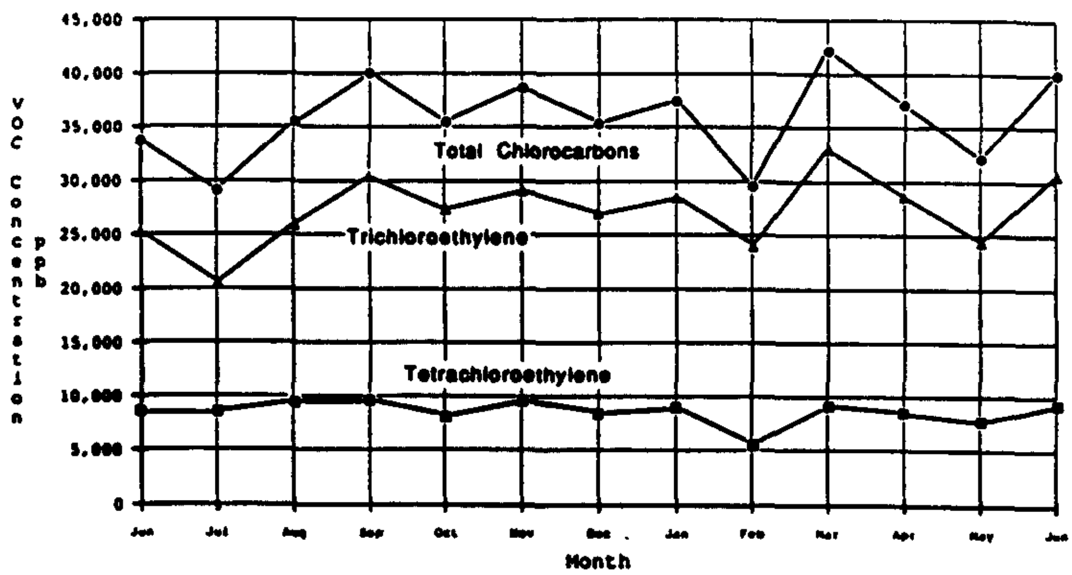
The pump and treat operation at the Wurtsmith AFB site has been operating for 13 years. At the Arrow Street area of the site, maximum initial TCE concentrations were approximately 29,300 ppb. Concentrations leveled after six years of pumping, with maximum concentration reductions of 99% and average concentration reductions of 90% (Table 1). Concentrations remained constant at approximately 400 ppb for five years until 1989, when concentrations dropped to approximately 70 ppb (Figure 2).

Harris Corporation, FL

The Harris Corporation site is contaminated with VOCs, with an initial maximum concentration of 10,000 ppb. After three years of pumping, VOC concentrations leveled at approximately 500 ppb, after a 95% reduction in maximum concentrations and an 87% reduction in average concentrations (Table 1 and Figure 3).



VOC Concentrations in Well RWM-3
(June 1988 to June 1989)



Average VOC Concentrations in Air Stripper Influent
(June 1988 to June 1989)

Figure 1. Leveling of VOC Concentrations, Savannah River Plant.
From: U. S. Department of Energy Savannah River Plant (1989). M-Area Hazardous Waste Management Facility Post-Closure Care Permit: Groundwater Monitoring and Corrective Action Program, Second Quarter 1989 Report.

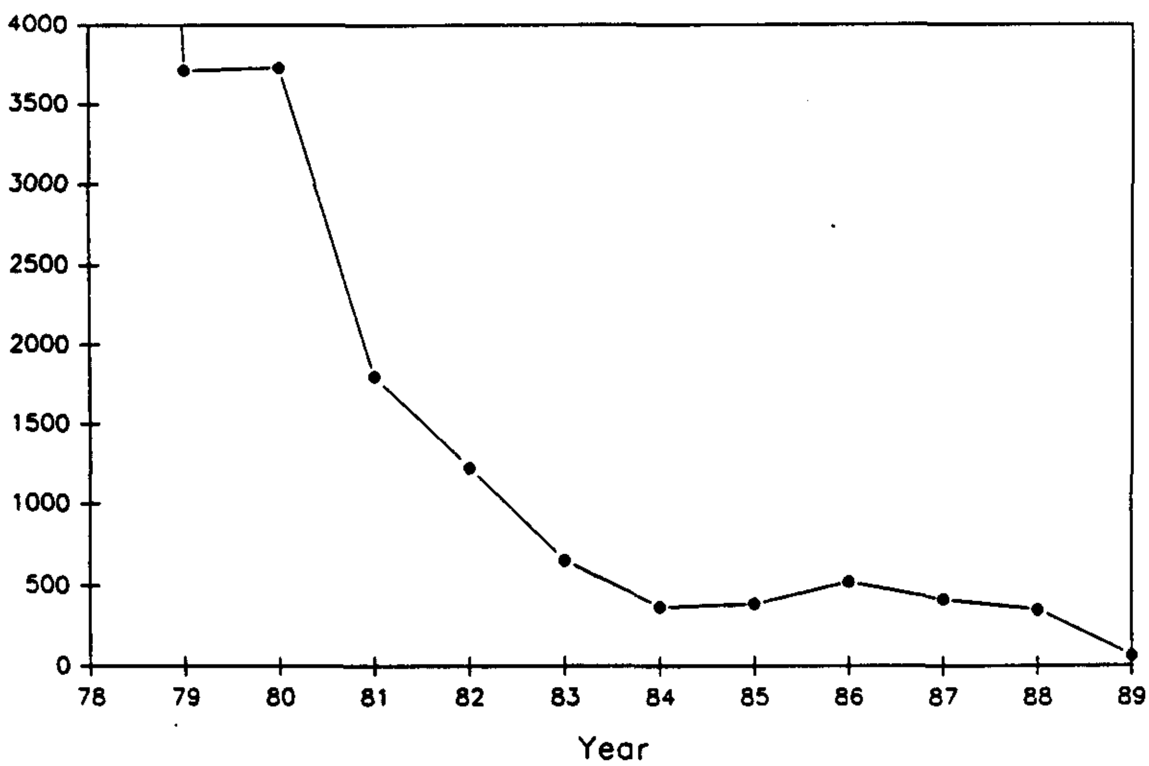


Figure 2. **VOC Influent Concentrations, Arrow Street Area, Wurtsmith AFB. Source: Wurtsmith AFB, 1990a.**

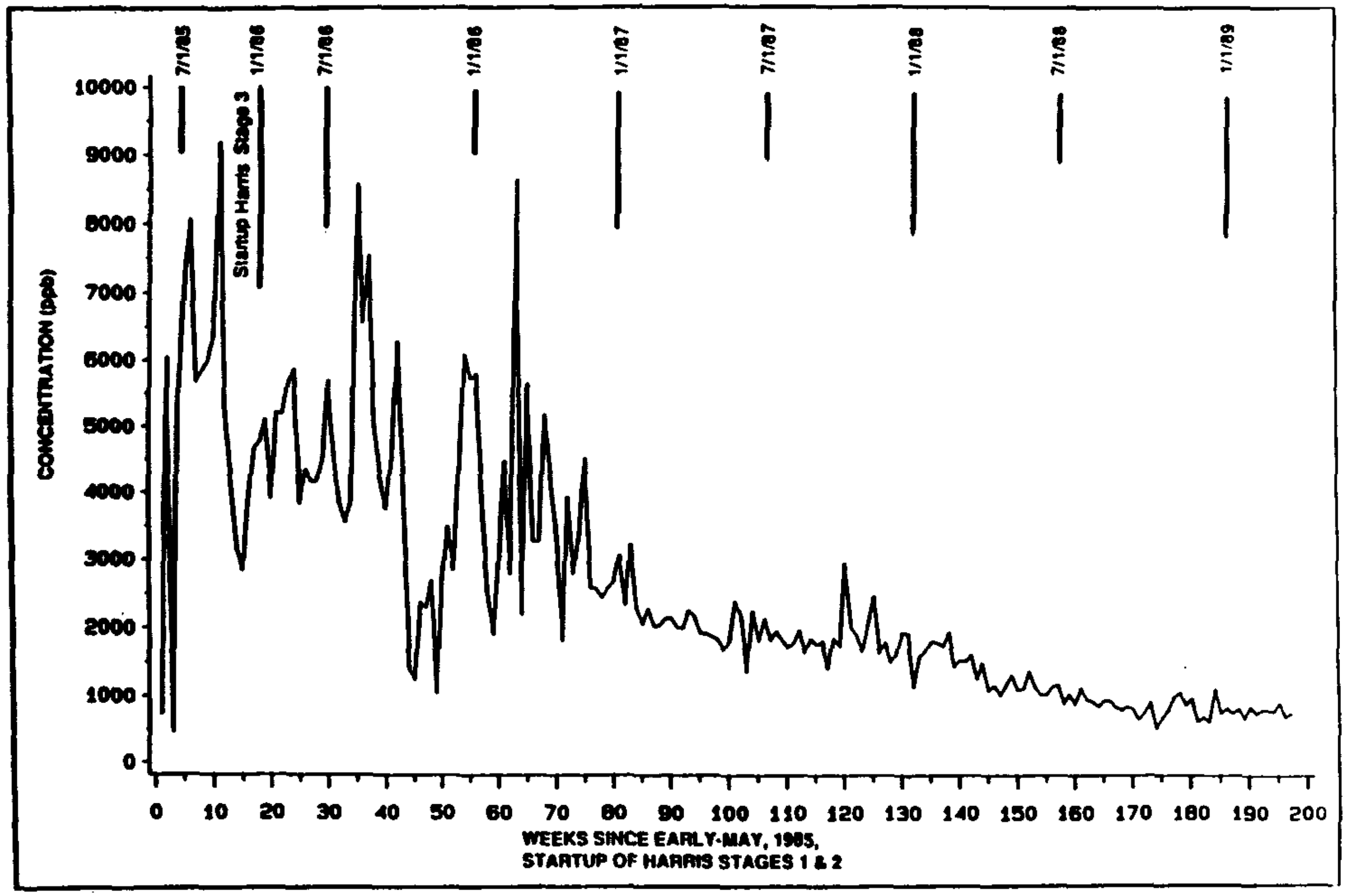


Figure 3. VOC Influent Concentrations, Harris Treatment System, Harris Corporation Site.
From: EPA 1989.

IBM Dayton, NJ

Initial maximum VOC concentrations at the IBM Dayton site concentrations were 15,700 ppb. Concentrations decreased to approximately 500 ppb after four years of pumping, increased slightly, and then leveled at approximately 100 ppb for several years prior to the discontinuation of the operations. Leveling of maximum concentrations took place after a reduction of 99% (Table 1). However, an average concentration reduction of only 67% was observed. When the pumps were turned on again two years later, PCE concentrations rose to over 13,000 ppb (Figure 4).

Amphenol, NY

The Amphenol site is a small site with initial VOC concentrations of 150 ppb. Although the contaminated soil was removed prior to the installation of the pump and treat system, concentrations leveled at approximately 35 ppb after one year of pumping (Figure 5). An average concentration reduction of 59% was attained prior to concentration leveling (Table 1).

3.1.1 Leveling Patterns

Leveling has taken place at 13 of the sites reviewed. Two of the sites involving organic constituents did not have available performance records that were complete enough for an analysis of concentration leveling. The performance record for the United Chrome site indicates a steady decline in concentrations since the beginning of the operation. However, chromium concentrations were 576 ppm at the end of 1989.

The concentration at which leveling occured and the point in the performance record that it occured varied, depending on site-specific factors such as the system design, the characteristics of the chemicals present, and the site conditions. However, several trends in concentration leveling were observed. Although a 99% reduction of maximum concentrations was attained prior to

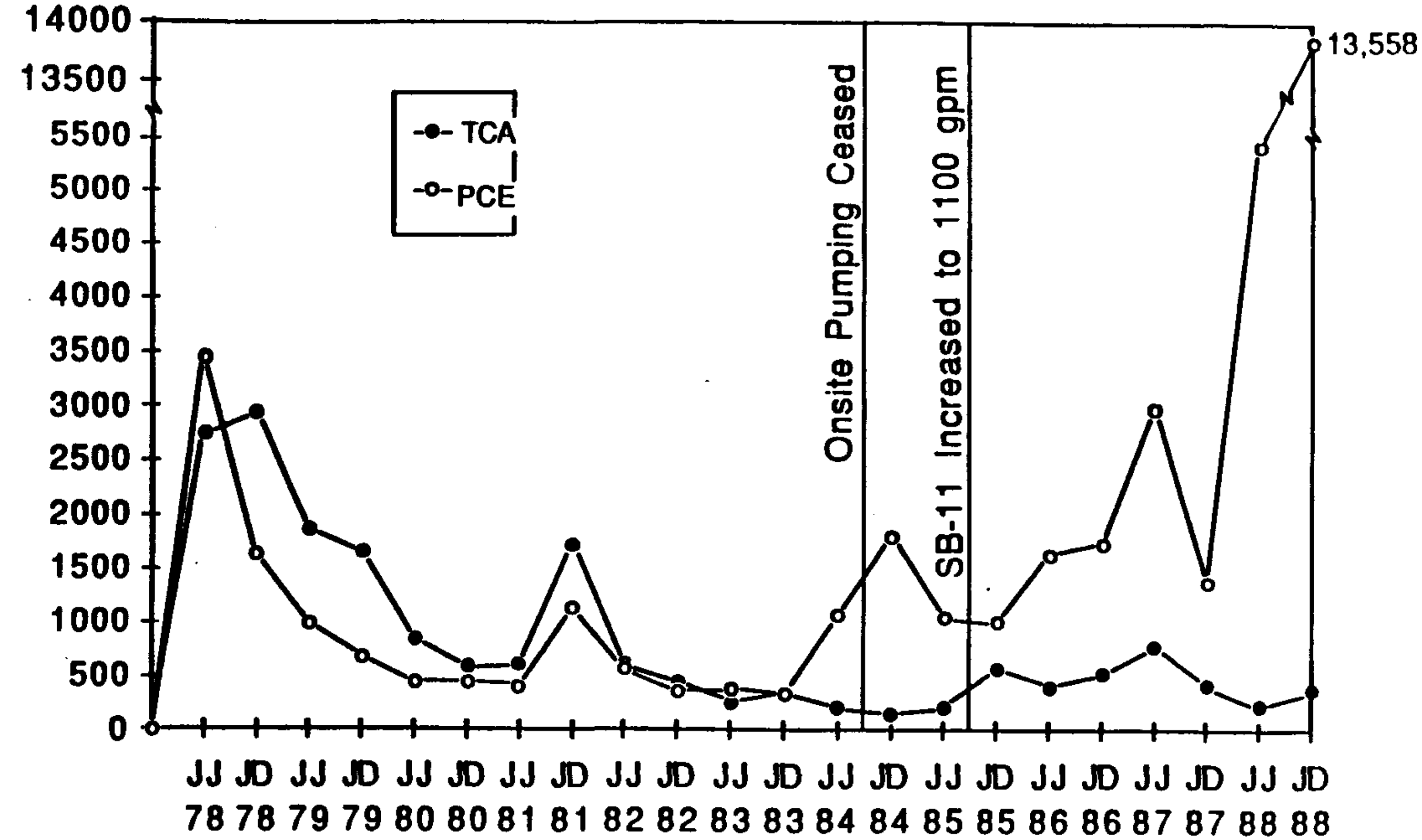
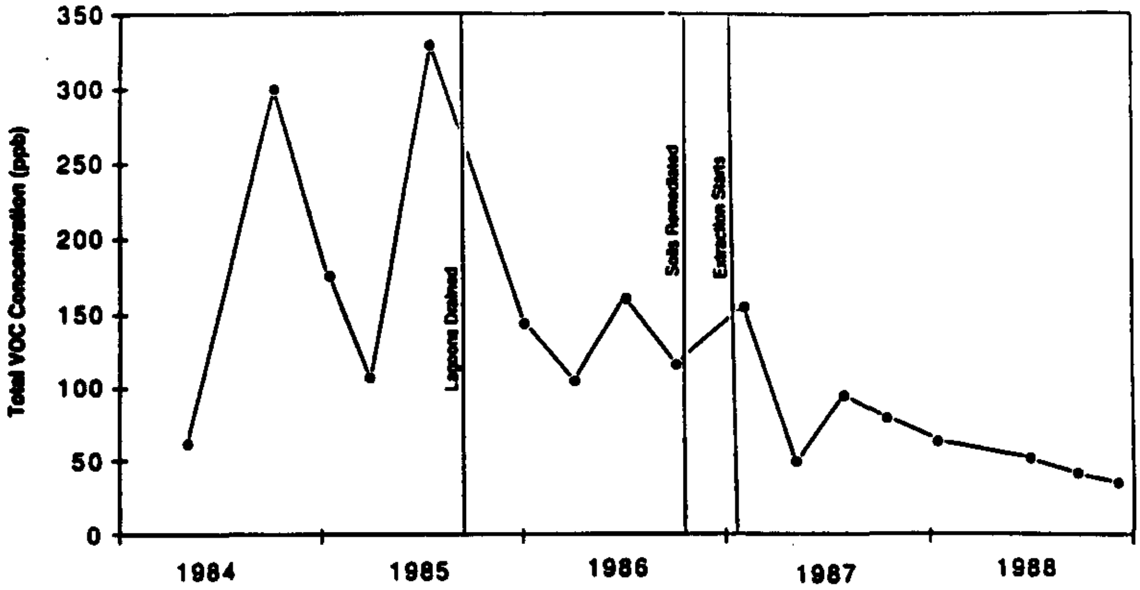


Figure 4. TCA and PCE Concentrations (ppb), Extraction Well GW32, IBM Dayton Site.
From: EPA 1989.



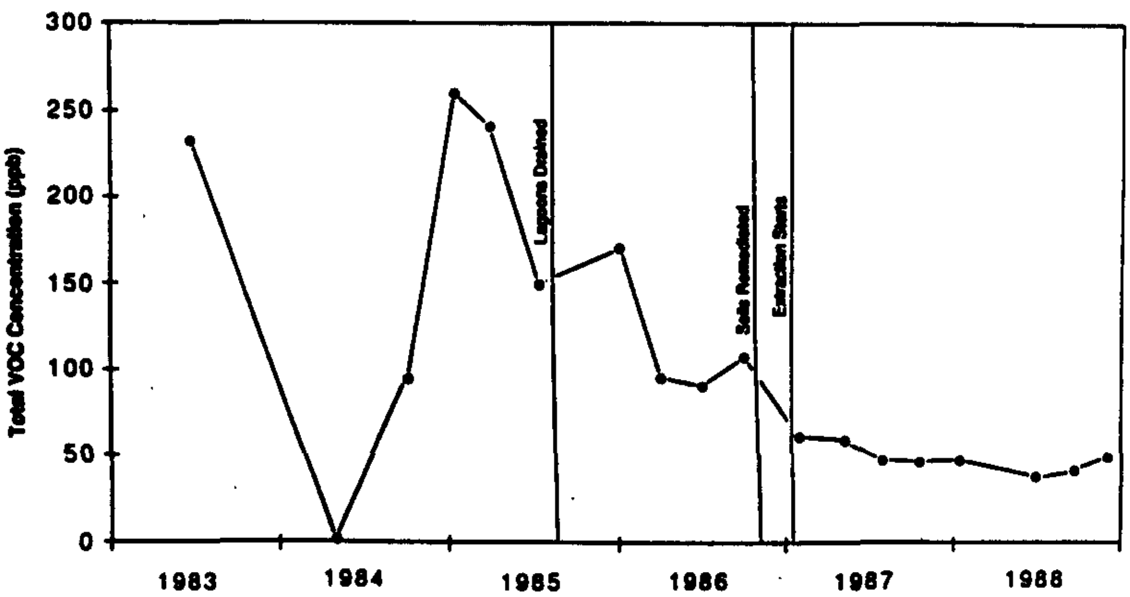


Figure 5. VOC Concentrations in Shallow Aquifer Wells 17-S and 1-S, Amphenol Corporation Site. From: EPA 1989.

leveling at some sites, the greatest reduction of average concentrations at a site was 90%. The following patterns in concentration leveling were observed:

- At all sites with maximum initial concentrations greater than 10,000 ppb, the concentrations leveled after maximum concentration reductions of 90% to 99%.
- Reduction of average concentrations ranged from 23% to 90% at sites with maximum concentrations greater than 10,000 ppb.
- At sites with initial maximum concentrations of 1,000 ppb to 10,000 ppb, leveling occurred after maximum concentration reductions of 85% to 99%. Reductions of average concentrations at these sites ranged from 50% to 87%.
- At sites with initial maximum concentrations between 100 ppb and 1,000 ppb, reductions in maximum concentrations range from 49% to 89%. Reductions of average concentrations ranged from 59% to 82%.
- At sites with initial maximum concentrations of 100 ppb, concentrations leveled after 0% to 50% reductions in concentrations.

Leveling patterns in the performance records reviewed illustrate the ineffectiveness of groundwater extraction in reducing average concentrations more than 90%. Even though leveling may take place at or near the cleanup goal (see Section 3.4), significant masses of contamination remain in the aquifer, and when pumps are turned off, concentrations rise again. Once concentrations level at a site, further significant reduction in concentrations is unlikely and cannot be accomplished within a reasonable time frame.

3.2 Capture and Containment of Contaminant Plume

An essential objective of pump and treat operations implemented for aquifer restoration is capture and containment of the contaminant plume. At the sites reviewed, analysis indicates that pumping can effectively contain the contaminant plume at most sites. At 75% of the sites reviewed, the performance record indicated that the plume is being effectively contained.

The Savannah River site is the only site reviewed with evidence of significant contaminant migration since the beginning of the operation. At this site, the plume is not contained, and contamination has migrated to lower aquifers. Although more than 168,000 lbs of contaminants have been extracted, the pumping rate of 400 gpm has proven to be inadequate for capturing the plume. Migration may also be attributable to the puncturing of the confining layer between the A and B aquifers and subsequent mobilization of perched NAPLs to deeper aquifers. The system has been recently re-designed with the objectives of containment and mass reduction.

At the Ponders Corner, IBM San Jose, and Harris Corporation sites, small portions of the plumes are not captured. At the IBM San Jose site, a small portion of the onsite plume does not appear to be captured, but is thought to be captured by the offsite wells. Likewise, at the Harris Corporation the portion of the plume not captured by the onsite system is captured by the wellhead treatment system on the adjoining property. A low-level portion of the plume is not captured at the Ponders Corner site.

The performance records reviewed indicate that adequate hydraulic plume containment is feasible using pump and treat systems at most sites. However, problems be may associated with pumping at the high rates needed for plume containment in some cases. Pumping at a rate high enough to contain a plume may result in aquifer dewatering and the recovery of larger amounts of mildly contaminated water to be treated.

3.3 Reduction of Contaminant Mass

Initial estimates of the contaminant mass present in the groundwater and cumulative measures of the mass extracted are often part of site performance records. These data can be useful for some purposes. However, the performance records reviewed indicate that these data are of limited use in determining the overall effectiveness of pumping in meeting cleanup objectives.

3.3.1 Comparison of Mass Estimates to Mass Extracted

Few of the sites reviewed documented both an initial estimate of the mass or volume of contaminants present in the groundwater and a summary of the mass of chemicals extracted to date (Table 2). Of the four sites for which such information is available, the initial inventory of contaminants was grossly underestimated. At the Verona Wellfield site, more than twice the originally estimated mass of contaminants has been extracted to date. At the Des Moines TCE site, concentrations have leveled after extraction of more than seven times the volume of contamination estimated to be present in both soil and groundwater.

At the Savannah River site, the original estimate has already been exceeded by more than a factor of three, and concentrations have leveled after less than half the revised inventory of contaminants have been extracted. This site is the only site reviewed where estimates of contaminant mass were updated after the initial estimate was made. However, a mass inventory analysis conducted in 1988 indicates that the revised estimate of 460,000 lbs is also inaccurate. Although air stripper mass-balance calculations showed that 138,000 lbs had been removed, the inventory indicated that 441,000 lbs were still present in the groundwater. Therefore, the latest estimate indicates an original contaminant mass of 580,000 lbs.

3.3.2 Mass Reduction vs. Concentration Reduction

Considerable reductions in the contaminant mass were being attained during the early stages of the operation at the sites reviewed (Table 2). However, reductions in contaminant mass are not indicators of reductions in aquifer concentrations. Although more than 193,000 lbs of VOCs have been extracted at the Savannah River site, average concentrations have leveled after reduction of 25%. At the Twin Cities AAP site, average concentrations remain unchanged after the extraction of more than 19,510 pounds of VOCs (Tables 2 and 3). At the IBM San Jose site, 84 lbs of 1,1-DCE have been extracted with no reduction in groundwater concentrations.

Table 2
Inventory of Contaminants in Groundwater

Site	Predicted Volume/ Mass of Contamination	Mass/Volume Extracted to Date
Savannah River, SC	59,000 lbs. (orig. est.) 460,000 lbs. (revised est.)	>193,000 lbs.
Verona Wellfield, MI	3,900 lbs. gw	>10,000 lbs.
United Chrome, OR	No estimate	>13,000 lbs.
Possden Corner, WA	1,534 lbs. gw	Not reported
Sylvester, NH	800,000 gal. total	Not reported
Twin Cities AAP, MN	75,000 lbs. gw	21,000 lbs.
Des Moines, TCE, IA	200 gal. total	1,500 gal.
IBM Dayton, NJ	400 gal. total	Not reported
GenRad Corporation, MA	No estimate	2.6 lbs.
IBM San Jose, CA	No estimate	7,700 lbs.

3.3.3 Mass Extraction Rates

Measures of the contaminant mass extracted, especially when used to determine the rate of contaminant extraction at a site, can be useful in determining the efficiency of a pump and treat operation. Table 3 illustrates the efficiency of pump and treat operations at sites with varying contaminants and initial concentrations during the first few years of operation. The difference between the extraction rates for the United Chrome site and the other sites listed in the table can be attributed to both the contaminant involved and the high initial concentrations. Contaminant extraction rates, although generally proportional to the initial concentrations, are much higher for inorganic contaminants than for organic constituents. For organics, large volumes of water must be pumped in order to extract a relatively small mass of contaminants.

Table 3
Mass Extraction Rates and Initial
Concentrations at Selected Sites

Site	Vol. of Groundwater extracted (gal.)	Mass Extracted (lbs.)	Max. Initial Concentration	Extraction Rate lbs/mil. gal
United Chrome, OR	1,664,000	13,376 ($Cr6^+$)	7,000 ppm	8,136
Savannah River, SC	782,000,000	168,000 (VOCs)	300,000 ppb	214.83
Twin Cities, MN	1,062,622,000	19,510 (VOCs)	20,000 ppb	18.36
IBM San Jose, CA	12,147,000,000	7,700 (VOCs)	100 ppb	.63
		84 (1,1-DCE)	5 ppb	.003
GenRad Corporation, MA	12,000,000	2.6 (VOCs)	1,000 ppb	.15

Our analysis indicates that contaminant mass reduction data is of limited use in determining the overall effectiveness of the pumping operation in reaching cleanup goals, but can be useful in determining the relative efficiency of a specific system. Because of the unreliability of initial mass estimates, the comparison of initial mass to the mass extracted is not an appropriate indicator of pump and treat effectiveness. These comparisons do, however, exemplify the difficulty in characterizing groundwater contamination and designing strategies to address the contamination. The analysis also indicates that cumulative measures of mass extracted are not reliable indicators of reductions in aquifer concentrations but that they are useful for deriving mass extraction rates. The mass extraction rates for the performance records reviewed illustrate the differences in efficiency among systems and the difficulty of extracting organic constituents at low concentrations.

3.4 Meeting Cleanup Goals

All the sites reviewed have aquifer restoration as the remedial objective. However, not all the sites have established health-based cleanup goals for the site. Quantitative cleanup goals were not established at two of the sites. Forty-four percent of the sites established cleanup goals at a negotiated level above health based standards for at least a portion of the site (Box 2). Another 44% of the sites established health-based cleanup goals (Box 3).

Box 2 - Status of Sites With Goals Above Health-Based Levels

United Chrome, WA:
Goal - 10 ppm Chromium
Results - Leveled at 600 ppm

Savannah River, SC:
Goal - Extract 99% of cont. mass
Results - Leveled after <25% red.

Sylvester, NH:
Goal - ACL of 1,500 ppb TCE
Results - 3,000 ppb; has exceeded predicted time frame by 100%

IBM Dayton, NJ:
Goal - 100 ppb VOCs
Results - Leveled at 100 ppb; after pumps were shut off, conc. rose to 13,000 ppb

Twin Cities AAP, MN:
Goal - 27 ppb TCE
Results - Although one-third of the estimated mass has been removed, concentrations unchanged at approx. 1,000 ppb

General Mills, MN:
Goal - 270 ppb TCE shallow
27 ppm deep aquifer
Results - Leveled above 500 ppb

Harris Corporation, FL:
Goal - 500 ppb VOCs
Results - Leveled at 1,000 ppb in three wells; 14,000 ppb in one well

Achieving concentration reductions to meet the cleanup goals for the sites is unlikely, even at sites where goals were established at levels significantly higher than drinking water standards (Box 2). The cleanup goal for the majority of the sites with drinking water standards as goals require concentration reductions to 5 ppb for contaminants such as TCE, PCE, and carbon tetrachloride (Box 3). At sites where the plume is contained and initial concentrations are at least 100 ppm, average VOC concentrations have leveled at concentrations of 35 ppb or greater in onsite-wells (Table 1), and large masses of contamination remain in the aquifer. When pumps are turned off, the concentrations rise again.

Box 3 - Status of Sites With Drinking Water Standards as Cleanup Goals

Verona Wellfield, MI:
Goal - MCLs VOCs
Results - Leveled at 2,500 ppb; conc. increased in some wells

Sharpe Army Depot, CA:
Goal - 5 ppb TCE
Results - Leveled at 100 ppb

Ponders Corner, WA:
Goal - 5 ppb PCE
Results - Leveled at 50 ppb

Des Moines TCE, IA:
Goal - 5 ppb TCE
Results - Leveled at 500 to 1,000 ppb

Amphenol Corporation, NY:
Goal - 5 ppb TCE
Results - Leveled at 50 ppb

Nichols Engineering, NJ:
Goal - 5 ppb carbon tetrachloride; 10 ppb total VOCs
Results - 80% to 90% reduction in some wells; overall, leveled at 150 ppb

IBM San Jose, CA:
Goal - 50 ppb TCA
Results - Concentrations have decreased to 50 ppb; however, contamination in shallow aquifer is acting as a continuous source of contamination.

4.0 PRIMARY FACTORS INFLUENCING EFFECTIVENESS

Several factors can contribute to the ineffectiveness of pumping for restoring aquifers (Table 4). The presence of unaddressed soil contamination and inadequately designed systems were often cited as primary contributors to the ineffectiveness of operations. Most of the ongoing pump and treat operations were designed based on limited site investigations, and determining the extent to which inadequate system design contributes to inefficiency is difficult. However, the primary contributors to the failure to meet cleanup goals are phenomena resulting from physical and chemical processes that affect the behavior of contaminants in the subsurface environment, such as contaminant sorption, contaminants in the non-aqueous phase, and zones of low permeability. All the sites reviewed have leveling patterns or other documented evidence to suggest that at least one of these factors is a major contributor to the ineffectiveness of the operation (Tables 1 and 4). Although systems can be designed to optimize efficiency, these fundamental processes and the problems they present serve

Table 4
Known Factors Contributing to the Ineffectiveness
of Pumping Groundwater at the Sites Reviewed

Site	NAPLs	Areas of Low Permeability	Plume not Contained	Soils not Remediated	Fractured Rock
Savannah River, SC	X	X	X	X	
Verona Wellfield, MI	X	X		X	X
Sharpe Army Depot, CA		X		X	
United Chrome, WA		X		X	
Ponders Corner, WA		X	X	X	
Sylvester, NH	X	X		X	X
Twin Cities AAP, MN				X	
Harris Corporation FL	X			X	
Wurtsmith AFB, MI				X	X
Des Moines TCE, IA				X	
IBM Dayton, NJ	X			X	
General Mills, MN	X			X	X
GenRad Corp., MA				X	
Amphenol, Corp., NY					
Nichols Engineering, NY	X			X	X
IBM San Jose, CA		X	X	X	

to greatly increase the remedial time frame and may not be overcome by additional site characterization and design modifications.

4.1 Continued Sources of Contamination

A major contributor to the ineffectiveness of pump and treat operations reviewed is the presence of a continued source of groundwater contamination. These sources consist of contaminated soils (the primary source), and immobilized contaminants in the vadose zone and subsurface (secondary sources). The remediation of surface or subsurface soils had been completed at only one of the sites reviewed (Table 4). Soils at the Amphenol Corporation had been excavated prior to startup of the pump and treat operation (Figure 5). Although soils had been excavated at the IBM San Jose site, significant vadose zone contamination was still suspected. Source remediation is underway at most of the sites reviewed but has not been completed.

Although completion of soil remediation is likely to increase the efficiency of the systems, at all the sites reviewed, contaminants sorbed to aquifer material, trapped in low permeability zones, or pooled in the non-aqueous phase serve as a continued secondary source of contamination. Because eliminating these secondary sources of contamination is technically infeasible at the present time, this factor will continue to be the primary contributor to the ineffectiveness of pump and treat systems, even after soil remediation is complete.

4.2 Contaminant Sorption and Desorption

Contaminants in groundwater partition between the water and organic matter in soils. Organic contaminants tend to preferentially sorb to the aquifer material, causing a reduction of the mobility of the contaminants relative to the flow of the groundwater. As groundwater is pumped, the chemicals are held back (retarded) by their adherence to the soil particles. The mass of contaminant sorbed to the aquifer material is generally significantly greater than the mass in solution. Thus, the aquifer materials act as a continuing source of contamination to groundwater.

Retardation is typically expressed in terms of a retardation factor, derived by dividing the average velocity of the groundwater by the average velocity of the contaminant (Mackay 1989). For example, TCE has been shown to have a retardation factors ranging from 1 to 40, depending on the composition of the aquifer material (McCarty 1989).

Sorption and retardation studies have shown, however, that retardation factors for organic solutes have a tendency to increase over time (Roberts et al. 1986), that soil long-contaminated with halogenated organic compounds is resistant to desorption (Pavlostathis and Jaglal 1991), and that the tailing of organic solutes is controlled by diffusion limitations (Goltz and Roberts 1986; Wu and Gschwend 1986; Pignatello 1990a,b). These studies suggest that contaminant desorption rates decrease over time and are limited by molecular diffusion from remote areas in the soil matrix. This results in concentration leveling and decreased contaminant extraction rates over time.

Although groundwater concentrations drop initially, large masses of contaminants may remain in the aquifer materials, and many pore volumes of water must be brought into contact with the soil particles in order to extract the contaminants. This process results in the recovery of very large volumes of mildly contaminated water (Table 3). The number of pore volumes of water that must be removed during a pump and treat operation depends on the sorptive tendencies of the contaminant, the volume of contamination in the non-aqueous phase, and groundwater flow velocities. However, the kinetic limitations of desorption result in lengthy and inefficient pumping operations. At the IBM San Jose site, combined pumping rates of 2,000 gpm at two boundary wells have pumped more than 5 billion gallons of groundwater over a four-year period. However, less than 800 lbs. of contaminants were extracted (EPA 1989).

4.3 Non-aqueous Phase Liquids

Many of the organic chemicals found at hazardous waste sites are immiscible in water and are likely to be present in a non-aqueous phase. They are, however, slightly soluble in water, and partitioning of components from the non-aqueous phase may result in the development of a dissolved plume in addition to the immiscible phase that acts as a continuous source of contamination. Contaminants such as chlorinated solvents, creosotes, and PCB oils are denser than water and sink to the bottom of the aquifer, leaving behind ganglia of residual contamination and becoming trapped in pore spaces by capillary action. Contaminants such as benzene, xylene, and toluene are lighter than water and float on top of the water table. The mass of contamination in the non-aqueous phase may be considerably greater than in the dissolved phase (Mackay and Cherry 1989).

Aquifer restoration within a reasonable time frame is infeasible at sites involving NAPLs. At best, even if eventual restoration were conceivable, predicting how long pumping and treating will take to restore an aquifer is not possible (MacKay and Cherry 1989). Although some success has been achieved in removing a portion of floating NAPL layers, little success has been achieved in locating dense NAPLs (DNAPLs), much less extracting them. When large pools of DNAPLs are present at the bottom of an aquifer, meeting drinking water standards is unachievable at any cost (Freeze and Cherry 1989).

Removing trapped NAPLs from the subsurface is infeasible because NAPLs cannot be mobilized under typical aquifer conditions. NAPL mobilization is controlled by mass transfer limitations in liquid phase dissolution (Hunt and Sitar 1988). The following calculation illustrates the time frame associated with DNAPL dissolution. For a site with only 1 m^3 of sandy soil contaminated with TCE at 30 l/m^3, assuming groundwater flow through the soils at a rate of 0.03 m/d, hydraulic conductivity of 10^{-3} cm/s, a hydraulic gradient of 1%, porosity of 30%, and dissolution of DNAPLs into the groundwater to 10% of their solubility, approximately 122 years would be needed for dissolution of DNAPLs into the groundwater (EPA 1990). This scenario is far more favorable than for the site conditions and the volume of DNAPLs that are likely to be present at the average hazardous waste site.

Forty-four percent of the sites reviewed involved either documented NAPLs or evidence suggesting the existence of NAPLs (Table 4). However, because of the constituents involved, the mass of contaminants, and the fact that contaminants have migrated into the deeper aquifers at the sites, the likelihood of pooled DNAPLs is great at all of the remaining sites involving chlorinated solvents as the primary contaminants.

4.4 Low Permeability Zones

The rate at which contaminants can be extracted using pump and treat is affected by advection, the process by which moving groundwater transports dissolved solutes (Fetter 1988). In heterogeneous systems where layers of varying permeabilities exist, pumping causes preferential flow in areas of high permeability. The more layered the geologic system, the longer the tailing effect (EPA 1990). The contaminants that remain in low permeability zones are removed very slowly by molecular diffusion. Even highly soluble contaminants may become trapped in the finer pore structure (Hall 1988). At the sites reviewed, at least 35% of the sites involved significant portions of the contaminant mass in such areas of low permeability (Table 4). As much as 90% of the contaminant mass is estimated to be present in zones of low permeability at the Ponders Corner site.

4.5 Fractured Rock

One third of the sites reviewed involved fractured bedrock (Table 4). At such sites, dissolved contaminants may enter the rock matrix by diffusion and be stored there by adsorption, greatly decreasing the likelihood that the contaminants can be removed (Mackay and Cherry 1989). When NAPLs enter fractured rock aquifers, they flow deep into the fractures, and little or no water can penetrate and flush these areas, further complicating the mobilization of NAPLs.

5.0 PREDICTING REMEDIAL TIME FRAMES

5.1 Groundwater Modeling at the Sites Reviewed

Modeling had been conducted at two-thirds of the sites reviewed. However, all but one used flow models with over-simplified and generic assumptions, resulting in a failure to consider the tailing effect observed at the sites. Thus, the overall time frames for the sites are underestimated by at least a factor of three. At the sites that projected remedial time frames, 25% of the sites have already exceeded remedial milestones by as much as a factor of two (Box 4). The underestimation of time frames can be attributed to both inadequate models and inadequate site characterization.

Box 4 - Remedial Time Frames at Sites Reviewed

Site	Length of Operation	Projected Time Frame
Amphenol Corp., NY	3 years	5-10 years
Des Moines TCE, IA	2.5 years	not projected
General Mills, MN	4 years	not projected
GenRad Corp., MA	2 years	>5 years
Harris Corp., FL	6.5 years	not projected
IBM Dayton, NJ	13 years*	6-11 years
IBM San Jose, CA	8 years	10 years
Nichols Eng., NJ	2.5 years	2.25 years
Ponders Corner, WA	6 years	10 years
Savannah River, SC	5 years	30 years
Sharpe Depot, CA	2.5 years	30 years
Sylvester, NH	4 years	ACLs 2 years
Twin Cities, MN	2 years	not projected
United Chrome, OR	2 years	5 years
Verona Wellfield, MI	6.5 years	100 ppb in 3 years
Wurtsmith AFB, MI	13 years	–

* Operation ceased for four years during this period.

At present, numerous factors which affect the transport of contaminants in the subsurface and the remedial time frame are not accounted for in groundwater models (Keely 1989; McCarthy and Zachara 1989; Mercer and Skipp 1990; van der Heijde et al. 1989). Such models typically:

- Consider only adsorption and advection
- Use generic retardation factors
- Do not consider dispersion, diffusion, or degradation
- Do not consider influences in vertical flow caused by partially penetrating wells
- Do not consider non-aqueous phase liquids
- Assume homogeneity
- Assume that aquifer is confined
- Assume uniform thickness
- Assume a steady-state flow field
- Do not consider colloidal transport of contaminants
- Are usually based on inaccurate mass inventories and inadequate site characterization.

Estimates of contaminant retardation are essential to predicting the length of time required to clean up an aquifer. At best, for a plume containing only dissolved and sorbed contaminants in a uniform homogeneous aquifer, the volume that has to be removed will equal the contaminated volume times the retardation factor, not considering hydrodynamic dispersion. However, retardation factors vary from site to site for the same chemicals and appear to increase over time. Although sorption was considered in the remedial design for at least two thirds of the sites reviewed, the retardation factors used in the analyses were generic and did not account for intra-particle diffusion. To date, no methods have been developed that would allow site-specific estimates of contaminant retardation over time, and predictions of cleanup time frames based on generic retardation factors are unreliable. The lack of a reliable method for estimating contaminant retardation over time is the primary factor contributing to the gross underestimation of remedial time frames in the sites reviewed.

5.2 Recent Modeling Studies

Recent modeling studies suggest that pumping and treating will not restore aquifers to drinking water standards within a reasonable time frame. Pump and treat time frames of 100 years may be needed in order to lower concentrations by a factor of 100, assuming a homogeneous aquifer (Mackay and Cherry 1989, McCarty 1989). For water-insoluble constituents such as jet fuel, assuming a 10-acre area with a 55-foot thick aquifer, 10% residual saturation, a pumping rate of 100 gpm, a soil: water partition coefficient of 0.75, oil: water partition coefficients of 3,000 and 11,000 for toluene and o-xylene respectively, and one year to exchange the fluid one time, thousands of years would be needed to remove the contaminants (Hall 1988).

6.0 EFFECTS OF PUMPING AND TREATING

Several phenomena associated with pumping and treating can complicate the cleanup effort or cause ecological damage. The following effects of pumping and treating have been observed:

- A large volume of uncontaminated water, many times the volume of contaminated water, must be used to flush the aquifer.
- Dewatering resulting from pumping can cause serious land subsidence and other ecological damage.
- When perched NAPLs exist, drilling can puncture the bed causing the pool to drain to a lower aquifer (Mackay and Cherry 1989).
- When the water table is lowered from a position above perched NAPLs, the NAPLs can become remobilized and drain to a deeper aquifer (Mackay and Cherry 1989).

Pumping causes changes in the flow and distribution of groundwater that can be ecologically damaging. The potential effects of dewatering are land subsidence and the loss of habitats for some local species. Pumping at the IBM San Jose site has resulted in the dewatering of the A aquifer. A ground-water balance estimate for the Santa Teresa Basin showed that 6,900 to 29,900 acre-feet of overdraft occurred in 1985 (EPA 1989).

The Savannah River site shows evidence of mobilization of contamination to deeper aquifers. Although the total mass of VOCs decreased during the first three years of operation, the mass increased in three of the deeper aquifers (Box 5). Although a discontinuous layer consisting of 70% silt and clay separates the Upper and Lower Congaree Units, the contaminant mass in the lower unit increased by 17,000 lbs. The Ellenton Sand unit is 32 to 95 feet thick and contains two major clay layers, one of which is the principal confining unit for the underlying Black Creek Formation. This unit, which is an important water-producing zone, was not contaminated before the pump and treat operation began and is now contaminated.

These effects should be considered and weighed against the benefits of pumping, given the infeasibility of aquifer restoration within a reasonable time frame. Although the need for the use of pumping and treating for plume containment or wellhead treatment may outweigh the potentially detrimental effects, the technology should not be used routinely or indiscriminately.

Box 5 - VOC Mass (lbs.)
Savannah River Site

Unit	1985	1988
Water table	179,000	208,336
Upper Congaree	259,400	188,854
Lower Congaree	23,500	41,084
Ellenton Sand	1,800	3,010

Source: USDOE, 1989

7.0 CONCLUSIONS

Although we conducted an extensive survey of pump and treat operations, we were unable to locate an aquifer in the U. S. that has been confirmed to be successfully restored through pumping and treating. Although the B and B Chemical site, an NPL site in Florida, is claimed by the responsible party to be cleaned up, the claim has not been substantiated by EPA, and the extent of remediation is questionable because the responsible parties failed to submit appropriate monitoring documentation (Personal communication, D. Danner, EPA Region 4). Another site, Emerson Electric, a site in Florida involving low-level contamination, is also claimed to be cleaned up. However, the validity of this claim is also questionable because doubt exists as to whether the plume was captured by the system, and confirmation sampling was inadequate (EPA 1989).

Although pumping and treating has generally been effective for containing the contaminant plume and reducing the mass of contamination at the sites reviewed, little success has been achieved in reducing aquifer contaminant concentrations to the established cleanup goals. Two of the review sites with the longest performance records, the IBM Dayton site and the Savannah River Plant site, have changed the remedial objective from restoration to reduction of contaminant mass because of the ineffectiveness of the pump and treat operation in meeting the remedial objectives.

At all the sites with performance records of more than two years, concentrations have leveled after an initial decline. For some sites, leveling may take place at relatively low concentrations, even though as much as 50% of the contaminant mass may still be present in the aquifer. Typically, once the pumps are turned off, concentrations rise again, often to levels higher than initial concentrations.

Based on our review of performance records and recent theoretical studies, the following can be concluded regarding aquifer restoration :

- **Groundwater pumping is ineffective for restoring aquifers to health-based levels.**
- **Pumping is effective for contaminant mass reduction, plume containment, and extraction of groundwater for point-of-use treatment.**
- **Although significant removal of the contaminant mass may be achieved, contaminant concentrations may not be significantly reduced.**
- **At sites where contaminant concentrations have leveled, concentrations remain significantly above drinking water standards.**
- **Even if target concentrations are reached, when pumps are turned off, concentrations rise again, often to levels higher than initial concentrations.**

- The primary contributors to the ineffectiveness of pumping for aquifer restoration are phenomena resulting from physical and chemical processes, such as contaminant sorption and the existence of non-aqueous phase liquids and zones of low permeability.

- The longest remedial time frame predicted in the performance records reviewied was 30 years. Recent modeling studies, however, estimate that pump and treat time frames of 100 to 1,000 years may be needed to restore aquifers.

Both performance records and modeling studies indicate that the pump and treat approach is ineffective for aquifer restoration within a reasonable time frame. No evidence exists that pumping can restore aquifers to a condition compatible with health-based standards. Containment, mass reduction, and wellhead treatment are presently feasible objectives for pump and treat systems, and future groundwater remedial action decisions and pump and treat system designs should be limited to these objectives.

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Appendix A

Summary of Effectiveness

NPL SITES

Site	Primary contaminants	Initial concentrations	Cleanup Goal	Duration of Operation	Pumping Rate	Status of Operation
Savannah River, SC	TCE PCE	250,000 ppb (max.) 150,000 ppb	Level acceptable to State of SC and/or removal 99% of contam. mass	5 years	400 gpm	Permeable and impermeable subsurface layers are contaminated with an estimated 260,000 to 464,000 pounds of solvents, and no significant reduction in concentrations or size of plume have been observed. VOC concentrations have leveled off with average influent concentrations at 40,000 ppb, and the system has not effectively captured plume. It is being re-designed with the remedial objective changed from restoration to reduction of contaminant mass.
Verona Wellfield, MI	VOCs	19,000 ppb (max.)	MCLs; 100 ppb after 3 yrs.	6.5 years	400 gpm	Substantial reduction of contaminant mass has been achieved. Overall, concentrations have leveled off above 2,500 ppb, and concentrations have increased in some wells.
Sharpe Army Depot, CA	TCE	290 ppb (ave.)	5 ppb	2.5 years	200 gpm	Original goal was emergency response to keep plume from drifting off-base. Although the plume is being contained and initial results were encouraging, concentrations have leveled off above 100 ppb and it now appears unlikely that the aquifer will be restored to meet drinking water standards. Concentrations in lower aquifer are not meeting expectations.
United Chrome, OR	Chromium (Cr6+)	6,860 ppm (max.) 1,923 ppm (ave.)	10 ppm (upper) 0.05 ppm (lower)	2 years	10 gpm	Although the average concentration for extracted groundwater was 576 ppm at the end of 1989 and a total of 13,376 lbs of chromium had been removed, concentrations have either increased or remained constant in many of the upper zone wells.

NPL SITES (continued)

Site	Primary contaminants	Initial concentrations	Cleanup Goal	Duration of Operation	Pumping Rate	Status of Operation
Ponders Corner, WA	PCE	500 ppb PCE (max.)	5 ppb	6 years	2,000 gpm	A portion of the plume is not being captured by the system and PCE concentrations are remaining persistent in the well closest to the source. It is estimated that 90 percent of contaminants are contained in low permeability zones.
Sylvester, NH	tetrahydrofuran toluene TCE	1,500,000 ppb (max.) 29,000 ppb (max.) 15,000 ppb (max.)	-- 2,900 ppb 1,500 ppb	4 years	300 gpm	A slurry wall was constructed, and ACLs were established for contaminated groundwater within the contained area. However, the estimated 2 year cleanup period has already been exceeded by 2 years.
Twin Cities AAP, MN	TCE	20,000 ppb (max.) outwash aquifer; 100 ppb (max.) bedrock aquifer	27 ppb	2 years	2,700 gpm	Maximum TCE concentration remains at 18,000 ppb; average influent concentrations have shown no decline and remain at approx. 1,000 ppb.
Harris Corporation, FL	VOCs	10,000 ppb (max.)	500 ppb	6.5 years	300 gpm	Pumping has reduced the VOC plume. Average VOC concentrations have leveled off above 500 ppb during the past two years. However, concentrations have leveled above 1,000 ppb in 3 extraction wells.
Wurtsmith AFB, MI	TCE	840 ppb (ave.)	--	2 years	--	Average influent concentrations remain at 70 ppb in one area and between 500 and 700 ppb in a second area.
Des Moines TCE, IA	TCE	8,467 ppb	5 ppb	2.5 years	1,000 gpm	Concentrations have leveled at between 500 ppb and 1,000 ppb. An additional source of contaminated is being investigated.

NON-NPL SITES

Site	Primary contaminants	Initial concentrations	Cleanup Goal	Duration of Operation	Pumping Rate	Status of Operation
IBM Dayton, NJ	TCA PCE	9,590 ppb (max.) 6,132 ppb (max.)	100 ppb	13 years	1,000 gpm	Six years of pumping lowered VOC concentrations to below 100 ppb. However, subsequent to shutdown of the operation in 1984, PCE concentrations rose to 12,558 ppb. Pumping was resumed in 1989 with the remedial objective changed from restoration to containment.
General Mills, MN	TCE	1,300 ppb (max.) shallow aquifer; 2,300 ppb (max.) Carimona aquifer	270 ppb (shallow) 27 ppb (Carimona)	4 years	300 gpm (shallow); 50 gpm (Carimona)	Substantial reduction of TCE concentrations has been achieved. However, aquifer concentrations have leveled off above target levels and remain as high as 460 ppb in one area.
GenRad Corporation, MA	VOCs (primarily TCE)	1,000 ppb (total) 270 ppb	–	2 years	30 gpm	TCE concentrations have been reduced to approximately 100 ppb.
Amphenol Corporation, NY	VOCs (primarily TCE)	230 ppb (max.)	5 ppb	3 years	200 gpm	VOC concentrations have leveled off at 50 ppb.
Nichols Engineering, NJ	CCl_4 PCE Chloroform	980 ppb (max.)	5 ppb	2.5 years	65 gpm	Average CCl_4 concentrations have leveled off at approximately 150 ppb and concentrations remain unchanged in one well.
IBM San Jose, CA	TCA	100 ppb	5 ppb	8 years	1,600 gpm	Average concentrations have leveled at 50 ppb. However, the 10 ppb portion of the plume has remained unchanged.

Appendix B

Abstracts for Performance Records Reviewed

SITES REVIEWED

NAME OF SITE:	Savannah River Plant (A/M Area)
LOCATION:	Aiken, SC
TYPE OF SITE:	Department of Energy research and weapons manufacturing facility (NPL)
CONTAMINANTS:	TCE, PCE
GEOLOGY:	Permeable and impermeable layers: sands, silts, and clays with a water table 60 to 120 feet below the land surface
SYSTEM DESIGN:	11 recovery wells with 400 gpm total pumping rate; 236 monitoring wells
STATUS:	Plume is not effectively contained. Average total chlorocarbon concentrations have leveled at approximately 15,000 ppb, and concentrations remain as high as 40,000 ppb in one well. System is being re-designed with the goal of remediation changed from restoration to contaminant mass reduction.
REFERENCES:	U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989. U. S. Department of Energy Savannah River Site (1989). M-Area Hazardous Waste Management Facility Post-Closure Care Permit: Groundwater Monitoring and Corrective Action Program Second Quarter 1989 Report. U. S. Department of Energy (April 1987). Application for a Post-Closure Permit, M-Area Hazardous Waste Management Facility, Volume III, Savannah River Plant. Personal communication (1989). Victor Weeks, Environmental Protection Agency, Region 4.

NAME OF SITE:	Verona Wellfield, MI
LOCATION:	Battle Creek, MI
TYPE OF SITE:	Municipal wellfield (NPL)
CONTAMINANTS:	1,1-DCA; 1,2-DCA; 1,1,1-TCA; 1,2-DCE; 1,1-DCE; TCE; and PCE
GEOLOGY:	Sand and gravel aquifer overlies an upper sandstone aquifer with clay lenses, a confining siltstone bed, a lower sandstone aquifer, and a layer of shale; sandstone contains extensive horizontal and vertical fracturing.
SYSTEM DESIGN:	Five barrier wells; 9 groundwater extraction wells screened in the water-table aquifer with total pumping rate of 400 gpm. A vapor extraction system has also been installed.
STATUS:	Substantial reduction of contaminant mass has been achieved. Efficiency of system has increased since installation of the vacuum extraction system. However, average total VOC concentrations have leveled off around 2,500 ppb.
REFERENCES:	U. S. Environmental Protection Agency (1989). "Evaluation of Groundwater Extraction Remedies" Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989. Environmental Protection Agency (1985). Record of Decision, Verona Wellfield, MI. Guerriero, Margaret (1989). In-Situ Soil Vacuum Extraction System, Verona Well Field Superfund Site, Battle Creek, Michigan. Final Report for NATO/CCMS Pilot Study on Remedial Technologies for Contaminated Soil and Groundwater.

NAME OF SITE:	Sharpe Army Depot, CA
LOCATION:	Lathrop, CA
TYPE OF SITE:	Army vehicle maintenance
CONTAMINANTS:	TCE
GEOLOGY:	Underlain by a complex sequence of interbedded sand, silt, and clay.
SYSTEM DESIGN:	System consists of 15 extraction wells with a total pumping rate of 200 gpm.
STATUS:	Although initial results were promising and the system has been successful in preventing migration of plume, concentrations in lower aquifer are not meeting expectations.
REFERENCES:	U. S. Army Toxic and Hazardous Materials Agency (USATHAMA) 1988. Remedial Investigation/Feasibility Study, Sharpe Army Depot, Lathrop, CA. Sharpe Army Depot (1990). Summary and Discussion of Results, NPDES Permit # CA 0081931. Personal communication (1990). Craig McPhee, USATHAMA.

NAME OF SITE:	United Chrome, OR
LOCATION:	Corvallis, OR
TYPE OF SITE:	Chrome plating facility (NPL)
CONTAMINANTS:	Chromium (hexavalent)
GEOLOGY:	Upper unconfined zone consists of clayey silt alluvium with a saturated thickness of 15 to 18 feet during winter and decreasing during the summer; during winter, saturated zone often reaches the ground surface. Lower confined aquifer ranges from 29 to 45 feet below the ground surface.
SYSTEM DESIGN:	System currently consists of 23 upper zone and 7 lower aquifer extraction wells with a total pumping rate of 17 gpm.
STATUS:	Average groundwater concentration was 576 ppm at the end of 1989 and a total of 13,376 lbs of chromium had been removed. However, concentrations have either increased or remained constant in many of the upper zone wells. A more extensive characterization of deep aquifer has been recently conducted.
REFERENCES:	City of Corvallis (1989). Monthly Operations Report, United Chrome Groundwater Extraction and Treatment Facility. CH2M Hill (1990). Deep Aquifer Report, United Chrome Products Site. CH2M Hill (1990). Personal communication, Randy Pratt. Environmental Protection Agency (1986). Record of Decision, United Chrome, OR.

NAME OF SITE:	Ponders Corner, WA
LOCATION:	Pierce County, WA
TYPE OF SITE:	Dry cleaning facility (NPL)
CONTAMINANTS:	PCE; TCE; 1,2-trans-DCE
GEOLOGY:	The uppermost geologic unit, the Steilacoom gravel unit, is generally unsaturated but has some perched saturated zones. The underlying Vashton Till, a semi-confining layer that has discontinuous saturated zones, is composed of silts and clays with sand and gravel lenses. The third geologic unit, the Advance Outwash unit, is the primary aquifer in the area. This highly layered fine to coarse sand and gravel unit is from 20 to 90 feet thick and lies at depths of 25 to 84 feet below the land surface. The Colvos unit underlies the Advance Outwash aquifer. This fine sand aquifer is less permeable than the Advance Outwash aquifer and may help prevent migration to deeper units.
SYSTEM DESIGN:	Two extraction wells are in operation with a total pumping rate of 2,000 gpm. Forty-two monitoring wells were originally installed, but some of these wells have been discontinued recently.
STATUS:	A portion of the plume is not being captured by the system and PCE concentrations have leveled between 50 and 100 ppb. It is estimated that 90 percent of contaminants are contained in low permeability zones.
REFERENCES:	Alliance Technologies Corporation (1989). Draft Case Summary, Ponders Corner (Lakewood) Site, Ground Water Extraction with Air Stripping, Soil Vacuum Extraction. CH2M Hill (1988). Final Aquifer Cleanup Assessment Report, Ponders Corner, Washington. Ecova Corporation (1989). Lakewood SVES Operation Summary. SEA645112.PM Environmental Protection Agency (1985). Record of Decision, Ponders Corner, WA. U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989. Environmental Protection Agency (1989). PERC and TCE Concentrations Measured in H1/H2 (Influent database), Ponders Corner, WA, Region 10.

NAME OF SITE:	Sylvester, NH
LOCATION:	Nashua, NH
TYPE OF SITE:	Hazardous waste dump (NPL)
CONTAMINANTS:	Tetrahydrofuran, toluene, TCE
GEOLOGY:	Silt, sands, and interbedded sediments overlying fractured rock
SYSTEM DESIGN:	Remediation consists of a 3-ft. slurry wall around the 20-acre contaminated area. Eight extraction wells are in operation with a total pumping rate of 300 gpm.
STATUS:	The two-year timeframe projected for reaching ACLs within the contained area has been exceeded by 2 years. Average THF concentrations remain at 15,000 ppb, average toluene concentrations are 50,000 ppb, and average TCE concentrations are 3,000 ppb.
REFERENCES:	Environmental Protection Agency (1982). Superfund Record of Decision (EPA Region 1) Sylvester Site, Nashua, New Hampshire (Initial Remedial Measure) Environmental Protection Agency (1988). Monthly Operations Summary, Gilson Road Groundwater Treatment Facility. Environmental Protection Agency (1990). Personal communication, Chester Janowski, Region 1.

NAME OF SITE:	Twin Cities Army Ammunition Plant, MN
LOCATION:	New Brighton, MN
TYPE OF SITE:	Ammunition production (NPL)
CONTAMINANTS:	TCE
GEOLOGY:	Organic soils, sands, and clays are underlain by cohesive and relatively impervious till. The third unit consists of glacial outwash and/or valley fill materials 100 to 350 feet below the land surface. This unit is underlain by a bedrock unit consisting of weathered and fractured dolomite overlying sandstone. Little hydraulic separation exists between the overburden and bedrock units.
SYSTEM DESIGN:	Six boundary extraction wells were originally installed; three months later, more wells were added to the system. Currently, 12 boundary wells and five wells downgradient of interior source areas are operating at a total pumping rate of 2,700 gpm.
STATUS:	Although the plume has been captured and more than 21,000 lbs. of VOCs have been extracted to date, maximum TCE concentrations remain as high as 18,000 ppb; average VOC influent concentrations remain unchanged at approximately 1,000 ppb.
REFERENCES:	U. S. Army Toxic and Hazardous Materials Agency (USATHAMA), 1986. Twin Cities Army Ammunition Plant Ground Water Remedial Action Alternatives Analysis. Twin Cities Army Ammunition Plant, 1990. Installation Restoration Program, Twin Cities Army Ammunition Plant Groundwater Recovery System (TGRS) 1989 Annual Monitoring Report and Monitoring Plan, Vols. 1 and 2. New Brighton, MN. Personal communication, 1990. Juan Boston, USATHAMA.

NAME OF SITE:	Harris Corporation, FL
LOCATION:	Palm Bay, FL
TYPE OF SITE:	Manufacturing facility (NPL)
CONTAMINANTS:	TCE, TCEA, vinyl chloride, methylene chloride, chlorobenzene, ethylbenzene, xylene
GEOLOGY:	The upper sand aquifer, an unconfined aquifer, is used locally as a water source. The layer below the upper aquifer is a 22-foot thick sandy clay layer that acts as a leaky aquitard, retarding groundwater flow between the upper aquifer and the 30-foot thick unconsolidated lower sand aquifer. Underlying the lower sand aquifer is the Hawthorne formation, a clay confining layer up to 200 feet thick. The fifth layer is the Floridan aquifer, a 1,000-foot thick sequence of limestone and dolomite.
SYSTEM DESIGN:	The current system consists of 11 extraction wells, four of which are deep aquifer barrier wells. The remaining wells recover ground water from both the shallow and deep aquifers. The pumping rate has remained constant since startup at 300 gpm.
STATUS:	Although the average treatment system influent VOC concentrations have declined and leveled at approximately 500 ppb, concentrations have leveled above 1,000 ppb in one shallow extraction well, two deep aquifer extraction wells, and one deep aquifer monitoring well. In one of the temporary onsite shallow monitoring wells installed in 1987, VOC concentrations fluctuated between 1 and 30,000 ppb during 1988 and 1989 and remained at 14,000 ppb during 1989. This contamination can be attributed almost exclusively to xylene and ethyl benzene, as opposed to TCE, DCEA, and vinyl chloride in the extraction wells.
REFERENCES:	U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989. Harris Corporation (1990). May 1990 Quarterly Sampling of Groundwater Monitoring Wells. Melbourne, Florida.

NAME OF SITE:	Wurtsmith AFB, MI
LOCATION:	Wurtsmith, MI
TYPE OF SITE:	Underground storage tank (non-NPL)
CONTAMINANTS:	TCE, DCE
GEOLOGY:	A sand and gravel unit is underlain by a clay unit at approximately 62 feet below the land surface. Clay beds exist in the sand and gravel unit in the northern part of the site at depths of 5 to 15 feet below the land surface. The clay unit separates the aquifer from the underlying bedrock.
SYSTEM DESIGN:	A two-well system began operation in 1978 at a pumping rate of 280 gpm. At that time, water was pumped into an aeration reservoir. A second aeration system was installed by 1979, consisting of six more wells with a pumping rate of 125 gpm. Later in 1979, the U. S. Geological Survey installed 217 monitoring wells both onsite and offsite. In 1981, the second aeration system was removed from service, and in 1982, the Arrow Street Purge Well System was installed with a pumping rate of 1200 gpm. A second system, the Mission Street system, consists of five extraction wells at a pumping rate of 220 gpm.
STATUS:	Concentrations remain at 70 ppb at the Arrow Street site after 13 years of pumping and between 500 and 700 ppb after two years of pumping at the Mission Street site.
REFERENCES:	Wurtsmith Air Force Base, 1990a. Groundwater Cleanup Factsheet. Wurtsmith AFB, MI. Wurtsmith Air Force Base, 1990b. 379 Strategic Hospital/SGPB, Wurtsmith AFB, Michigan, Water Sampling Information. Wurtsmith Air Force Base, 1989. Wurtsmith AFB, MI; 4853-5300; 1989 Water Quality Data. Personal communication, 1990. Mike Nicio, Wurtsmith AFB. U. S. Geological Survey, 1983. Groundwater Contamination at Wurtsmith Air Force Base, Michigan. Water Resources Investigation Report 83-4002, Lansing, MI.

NAME OF SITE:	Des Moines, TCE, IA
LOCATION:	Des Moines, IA
TYPE OF SITE:	Municipal wellfield (NPL)
CONTAMINANTS:	TCE, T-1,2-DCE, and vinyl chloride
GEOLOGY:	The area is underlain by a layer of silt and clay and a layer of unconsolidated sand and gravel. These layers are underlain by consolidated shale, siltstone, and sandstone. Below this system lies consolidated dolomite, limestone, sandstone, and shale formations. Three primary aquifer systems are associated with the site, two of which are important sources of drinking water in the area.
SYSTEM DESIGN:	Seven recovery wells were initially installed with a total pumping rate of 1,300 gpm. Six of these wells are still in operation at a pumping rate of 1,000 gpm.
STATUS:	Concentrations have leveled at between 500 ppb and 100 ppb. An additional source of contamination is being investigated.
REFERENCES:	U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989. Dico Company, Inc., 1989. Performance Evaluation Report No. 3, Groundwater Recovery and Treatment System, Des Moines TCE Site, Des Moines, Iowa. Dico Company, Inc., 1990. Performance Evaluation Report No. 4, Groundwater Recovery and Treatment System, Des Moines TCE Site, Des Moines, Iowa.

NAME OF SITE:	IBM Dayton, NJ
LOCATION:	South Brunswick, NJ
TYPE OF SITE:	Electronics manufacturing facility (non-NPL)
CONTAMINANTS:	1,1,1-TCA and PCE
GEOLOGY:	The shallow unconfined aquifer is comprised of the two upper geologic units which consist primarily of clay, silt, and gravel. These units are underlain by a thin discontinuous clay layer. The lower semi-confined aquifer consist of a sand and gravel unit underlain by relatively impermeable shale.
SYSTEM DESIGN:	Initial system installed in 1978 consisted of 13 shallow aquifer extraction wells, one deep aquifer extraction well, 1 offsite production well, and 100 monitoring wells. The average pumping rate was 300 gpm with a maximum pumping rate at the offsite well of 500-600 gpm.
STATUS:	Six years of pumping lowered VOC concentrations to below 100 ppb. However, subsequent to shutdown of the operation in 1984, PCE concentrations rose to 12,558 ppb. Pumping was resumed in 1989 with the remedial objective changed from restoration to containment.
REFERENCES:	U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989.

NAME OF SITE:	General Mills, MN
LOCATION:	Minneapolis, MN
TYPE OF SITE:	Food research laboratory (non-NPL)
CONTAMINANTS:	TCE, TCA, PCE
GEOLOGY:	Thirty to fifty feet of unconsolidated alluvial and glacial deposits are underlain by a sequence of fractured sandstone, shale, dolomite, and limestone.
SYSTEM DESIGN:	Five shallow aquifer extraction wells are operating with a pumping rate of 370 gpm. One extraction well is in operation in the lower (Carimona) aquifer with a pumping rate of 50 gpm.
STATUS:	Substantial reduction of TCE concentrations has been achieved. However, aquifer concentrations have leveled off above target levels and remain as high as 460 ppb in one area.
REFERENCES:	U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989.

NAME OF SITE:	GenRad Corporation, MA
LOCATION:	Bolton, MA
TYPE OF SITE:	Scientific and medical equipment mfg. (non-NPL)
CONTAMINANTS:	TCE
GEOLOGY:	Unconsolidated glacial deposits overlie metamorphic rocks. In low-lying areas, organic sediments overlie sands and gravels. Depth to groundwater is generally only five feet.
SYSTEM DESIGN:	Two plumes are present at the site. Two extraction wells have been installed to address the eastern plume at a pumping rate of 30 gpm. Sixteen monitoring wells are in operation. Northern plume discharges to a nearby river, and is not being addressed by the system.
STATUS:	TCE concentrations have been reduced to approximately 100 ppb after two years of pumping.
REFERENCES:	U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989.

NAME OF SITE:	Amphenol Corporation, NY
LOCATION:	Sidney, NY
TYPE OF SITE:	Electrical connector manufacturing facility (non-NPL)
CONTAMINANTS:	TCE, Chloroform
GEOLOGY:	A 100 to 200 foot thick layer of alluvial materials are underlain by glaciofluvial sands and gravels.
SYSTEM DESIGN:	One shallow aquifer extraction well and one deep aquifer extraction well are in operation with a total pumping rate of 200 gpm. Seventeen monitoring wells were initially installed, but some have been discontinued.
STATUS:	Although initial maximum VOC concentrations were only 230 ppb, concentrations have leveled off at 50 ppb.
REFERENCES:	U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989.

NAME OF SITE:	Nichols Engineering, NJ
LOCATION:	Hillsborough, NJ
TYPE OF SITE:	Combustion research facility (non-NPL)
CONTAMINANTS:	Carbon tetrachloride, PCE, chloroform
GEOLOGY:	Silty soil overlies fractured shales, siltstone, and sandstones.
SYSTEM DESIGN:	One recovery well was installed initially with a pumping rate of 65 gpm. Two more extraction wells were installed in 1989 with a pumping rate of 70 gpm.
STATUS:	Average carbon tetrachloride concentrations have leveled at between 100 and 200 ppb and have remained unchanged in one well.
REFERENCES:	U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989.

NAME OF SITE:	IBM General Products Division, CA
LOCATION:	San Jose, CA
TYPE OF SITE:	Electronics manufacturing facility (non-NPL)
CONTAMINANTS:	Freon 113, TCA, 1,1-DCE, and TCE
GEOLOGY:	The valley floor is underlain by a sequence of alternating sand and gravel layers separated by silt and clay layers. Bedrock in the area consists of consolidated sandstones, shales, cherts, serpentinite, and ultrabasic rocks. Contamination is distributed throughout four aquifers at the site.
SYSTEM DESIGN:	The extraction system consists of three components: an onsite system at the source areas, a boundary system, and an offsite system. The original system consisted of three wells in the source areas screened in the A aquifer, 19 boundary wells screened in the A, B, and C aquifers, and four offsite wells screened in the B and C aquifers. The total pumping rate was approximately 6,000 gpm. Pumping in many of these wells has been discontinued, however, because of dewatering. Pumping in the source areas has been continued, and only one A aquifer well is still in operation. The current total pumping rate is approximately 1,200 gpm.
STATUS:	Average concentrations have leveled at 50 ppb. However, the 10 ppb and 1 ppb portions of the plume have remained unchanged.
REFERENCES:	U. S. Environmental Protection Agency (1989). Evaluation of Groundwater Extraction Remedies, Vols. 1 and 2; Office of Solid Waste and Emergency Response; EPA/540/0289/054; Washington, DC, 1989.

Record of Decision

Site Name and Location
Coshocton City Landfill
Coshocton, Ohio

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Coshocton City Landfill site developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 and is consistent with the National Oil and Hazardous Substances Pollution Contingency Plan to the extent practicable.

This decision is based upon the contents of the administrative record for the Coshocton City Landfill site.

The State of Ohio concurs on the selected remedy.

Description of the Remedy

The selected remedial alternative for the Coshocton City Landfill site is to cover the landfill with a low permeability cap and undertake other actions required by State sanitary landfill closure requirements. The major components of the selected remedial alternative are:

- Complete site fencing and posting

- The recordation of notice in the chain of title regarding uses to which the property has been put, and any restrictions on its future use, referred to herein as "deed restrictions"

- Site grading to promote precipitation runoff and reduce infiltration

- Site capping which meets State solid waste landfill requirements and which minimizes leachate generation and prevents direct contact with contaminated materials

- Top cover of topsoil and revegatation

- Site monitoring including groundwater monitoring, surface water monitoring and landfill gas monitoring to determine the effectiveness of above measures and to provide early alert as to the need for other actions

The following components will be evaluated during the Remedial Design (RD) and will be included if necessary:

- Landfill gas collection and venting system
- Leachate and groundwater collection and on-site storage system with facilities for truck loading
- Provisions for on-site or off-site treatment and disposal of collected leachate and groundwater at a local POTW (The Coshocton POTW was used for evaluation and cost estimation)

Consistent with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300, I have determined that, at the Coshocton City Landfill site, the selected remedial alternative is cost-effective, provides adequate protection of public health, welfare and the environment, and utilizes treatment to the maximum extent practicable.

The action will require operation and maintenance activities to ensure continued effectiveness of the remedial alternative as well as to ensure that the performance meets applicable State and Federal surface and groundwater criteria.

I have determined that the action being taken is consistent with Section 121 of SARA. The State of Ohio has been consulted and concurs with the selected remedy.

Declaration

The selected remedy is protective of human health and the environment and attains Federal and State requirements that are applicable or relevant and appropriate to this remedial action and is cost effective.

This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threats of the site was not found to be practicable, this remedy does not employ treatment as a principal element of the remedy.

Because this remedy will result in hazardous substances remaining on-site, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Valdas V. Adamkus

Valdas V. Adamkus
Regional Administrator

June 17th, 1988

DATE

I. SITE NAME, LOCATION, AND DESCRIPTION

The Coshocton Landfill is located on approximately 80 acres in the east half of Section 3, Franklin Township, Coshocton County, Ohio, 3.5 miles southeast of the City of Coshocton, Ohio. Site access is by an unimproved road south of State Highway 83.

The Coshocton Landfill is located between two small intermittent creeks that drain toward the southwest into the Muskingum River, 1.5 miles west of the site. Within a quarter mile of the site, topographic relief exceeds 200 feet, the elevation varies from about 800 to 1,000 feet msl.

Coshocton County is on the western edge of the Appalachian Plateau. The area is characterized by considerable topographic relief with small streams situated between steep hills. The topography is steeply rolling; level land available for tillage is primarily in the river valley bottom lands.

Active, abandoned, and reclaimed coal strip mines are scattered throughout the region. Coshocton Landfill is built on abandoned, strip-mined land. Until early 1986, an active coal strip mine was operating to the immediate east of the site. Much of the land to the south and to the west of the site has been mined and reclaimed.

The uplands area around the landfill is sparsely populated. Homes are generally associated with small farms. Drinking water in the area is supplied by individual private wells. The steep topography in the immediate vicinity of the landfill limits the use of the surrounding land for agriculture. Most of the land is either woodlands or pasture land used for cattle grazing. Livestock have been observed using the two small intermittent creeks as a source of drinking water.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The earliest documented economic development activity at the Coshocton Landfill property was subsurface shaft mining of the Middle Kittanning Coal in the early 1900's. An extensive network of mine shafts was reportedly developed under portions of what is now the landfill property, but the full extent and date of termination of mining activities are unknown.

Portions of the landfill property were strip mined for further removal of the Middle Kittanning Coal from the mid-1950's until mid-1979. In July 1978, the City of Coshocton signed a coal lease with the Conotton Land Company, which subsequently relinquished the mineral rights to Cravat Coal Company. Cravat Coal Company has mined portions of the Coshocton Landfill property.

During strip mining, overburden and coal were removed to track the No. 6 coal seam into the hillside. The stripping operation removed material down to the base of the Middle Kittanning Coal seam that occurs across the site at approximately elevation 870 to 860 feet msl. Historical air photos show that the overburden or mine spoils were deposited behind the active mining operation, in areas where overburden and coal had already been removed. This was typical practice for strip mining in the area.

Mining probably ceased at the Coshocton site when the over-burden thickness rendered coal recovery uneconomical. When mining ceased, an exposed steep rock face known as the "high wall" remained.

At the conclusion of mining operations, portions of the gap between the spoil bank and high wall filled with water from groundwater or surface water, creating what are known as "spoil ponds". At least four spoil ponds existed along the abandoned high wall at the Coshocton Landfill site as of 1965. One of these spoil ponds remains and is located west of the site just outside the City of Coshocton property line.

ENFORCEMENT HISTORY

On March 30, 1984, U.S. EPA issued a unilateral administrative order to the City of Coshocton requiring it to undertake some interim measures, primarily to protect surface water and to address the leachate being generated. (V-W-84-C-006)

On November 29, 1984, U.S. EPA determined that the City's proposal, with amendments specified by EPA, complied with the terms of the order. By letter dated April 16, 1986, U.S. EPA agreed to relieve the City of its obligation to perform quarterly sampling.

III. COMMUNITY RELATIONS

The Remedial Investigation (RI) and Feasibility Study (FS) were put out for public comment on February 8, 1988. The Administrative Record, which included the Endangerment Assessment (EA), was added on February 25, 1988. The comment period was extended twice and closed on March 17, 1988. All of these materials, including the proposed plan, were available for review at the Coshocton Public Library.

A public meeting was held on February 23, 1988. A presentation on the RI and FS was made and then a question and answer session, as well as an opportunity for making public comments, was held. Public comments were also submitted to U.S. EPA by mail. A Responsiveness Summary to these comments was compiled and it is attached.

IV. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The selected remedial alternative for the Coshocton City Landfill is to cover the landfill with a cap. Unless the continued monitoring at the site identifies additional problems which need to be addressed, this will be the final remedy for the site. The cap which is placed on the site in conformance with the State sanitary landfill closure requirements, should prevent any migration of the hazardous substances which have been identified as having been placed in the landfill.

V. SITE CHARACTERISTICS

During active operation, the landfill accepted a variety of industrial wastes, including hazardous substances from several local industries. Based on data from city files and information submitted by local industries as reported in the endangerment assessment, materials listed below were accepted as drummed waste liquids:

- Alcohol
- Acetone
- Epoxy resin
- Phenolic resin
- Melamine resin
- Xylene
- Perchloroethylene
- Mineral spirits
- Plasticizers
- Neoprene

Other industrial solid waste disposed of at the site included rotocyclone scrubber dust, plastic particles, paper coloring pigments (brown iron oxide, calcium carbonate, chrome green, and tan iron oxide), paraffin wax, sawdust, waste-activated sludge, scrap plastic, scrap rubber, floor sweepings, and miscellaneous trash.

VI. SUMMARY OF SITE RISKS

The Coshocton Landfill site is releasing contaminants to the environment. The major release mechanism is leachate migrating to surface water. However, the extent of the leachate's migration to ground water is unclear. Results of samples taken from leachate, ground water, surface water, and sediment identified approximately 30 chemical constituents. Based on this as well as other data relevant to the site, indicator chemicals identified at the site include 2-butanone (methyl ethyl ketone), carbon disulfide, 1,1-dichloroethane, polynuclear aromatic hydrocarbons (PAH), 1,1,1-trichloroethane, pentachlorophenol, heptachlor and heptachlor epoxide, phthalates, toluene, vinyl chloride, xylene, copper, nickel, and zinc. The fate and transport information, as it relates to groundwater, indicates that for the inorganics, arsenic, copper, nickel, and zinc, sorption will be the main process that will influence their migration. Nickel is expected to be the most mobile of this group. Of the organics, 2-butanone, carbon disulfide, toluene, and xylene may move with the bulk water flow, but are subject to biodegradation; phthalates, PAHs, and heptachlor may sorb to particles and not move with the bulk water flow; and vinyl chloride may move with the bulk flow. In surface water, the inorganics are subject to sorption and complexation; sorption may decrease mobility while complexation may increase mobility. The organics that will most likely volatilize form surface water are 2-butanone, carbon disulfide, 1,1-dichloroethane, 1,1,1-trichloroethane, toluene, vinyl chloride, and xylene. Phthalates, PAHs, and heptachlor are expected to sorb to particles and deposit in the sediments.

The following risks were identified at the site:

A. Ingestion of Contaminated Ground Water

Incremental carcinogenic risks from the ingestion of ground water exceeded a risk of 1E-06 based on the maximum concentrations for the following contaminants: Upper aquifer-arsenic (3E-04) and bis(2ethylhexyl) phthalate (4E-06).

The levels of all contaminants, which have MCLs established and were identified at the site, were below these MCLs. MCLs are considered protective of human health and are the maximum amount of these contaminants allowable in drinking water.

B. Ingestion of or direct contact with contaminated Surface water

Incremental carcinogenic risks from the ingestion of surface water exceeded a risk of 1E-06 for arsenic (3E-06) only.

Concentrations of some constituents in the surface water and sediment were close to chronic concentration values of concern for aquatic life, but these chronic concentration values were not exceeded.

C. Ingestion of or direct contact with contaminated leachate

Incremental carcinogenic risks from the ingestion of leachate was below 1E-06 for all contaminants.

D. Ingestion of contaminated soil

Incremental carcinogenic risk from the ingestion of soil exceeded a risk of 1E-06 only for arsenic (3E-06) when pica behavior was assumed.

INGESTION OF MATERIAL NOT USUALLY [illegible]

VII. DISCUSSION OF CHANGES FROM PROPOSED PLAN

CERCLA Section 117(b) requires that the final selected remedial action plan be accompanied by a discussion of any significant changes from the proposed plan and of the reasons for such changes. U.S. EPA has received additional information since the publication of the proposed plan, which it has reviewed and analyzed together with information which was already in its possession.

Such new information and data received by the Agency in response to the publication of the proposed plan include the following:

CHECK FILES FOR THE LETTER

1. A letter dated March 16, 1988 was received from Richard L. Shank, Director of the Ohio Environmental Protection Agency; commenting on the Feasibility Study. That letter clarified the Ohio Solid Waste regulations as they pertain to the type of material which may be used to construct a barrier over a solid waste landfill, the depth of cover which must be applied over the barrier, whether a sand drainage layer is necessary, whether a gas ventilation system is required to be constructed, and whether a leachate collection system is appropriate at this time. Generally, the Director recommended that a determination as to each of these issues be deferred to the remedial design stage of the process.

2. A copy of a letter dated August 28, 1980 from Richard Anderson, Project Engineer for General Electric, to Deborah J. Berg of the Ohio EPA with accompanying analytic test results, and a copy of a letter in response, dated December 16, 1980, from Berg to Anderson, were obtained. Said correspondence indicates that the waste generated by General Electric referred to as "Roto Clone Sludge" was determined by Ohio EPA to be "non hazardous". Since large volumes of this waste were disposed of in the Coshocton Landfill, such a determination has implications for whether regulations and standards governing hazardous wastes or those governing solid wastes are more "appropriate" in selecting a remedy for this site.

Given this new information, U.S. EPA reviewed and analyzed some of the information already in its possession. Specifically, it revisited the "applicable or relevant and appropriate" issue, as discussed herein. In general, the state's clarification of its solid waste regulations and the factoring of the roto-clone sludge information into an analysis of the relative volumes of hazardous and solid wastes, all support a modification of the proposed remedy.

VIII. DESCRIPTION OF ALTERNATIVES

Alternatives 1 (AA-1) thru 5 (AA-5) were described in the Proposed Plan. As a result of the public comments and a review of the alternatives with regard to those comments, a new alternative which will be referred to as the "chosen alternative", was developed. The chosen alternative is described between alternative 3 and alternative 4, hereafter.

Alternative 1 (AA-1) is the no action alternative. This alternative will not provide protection for the public health or the environment. The substantial threat of release of contaminants that may present an imminent and substantial danger to public health and welfare and the environment would remain because there is reasonable evidence that there are substantial quantities of hazardous substances and pollutants remaining in the waste mass. These substances could pose a threat to public health if released and public exposure should occur. Alternative 1 would not meet applicable State landfill closure and post-closure care regulations.

Alternative 2 (AA-2) incorporates legal deed restrictions, fencing and posting for the property. Groundwater, surface water and sediment would be monitored on regular bases.

AA-2 addresses the risks associated with soil contact through deed restrictions to prohibit excavation for future development and fencing to restrict and reduce the probability of direct soil contact. AA-2 would not reduce infiltration and potential future transport of contaminants from the landfill contents. Groundwater monitoring would be focused on metals, selected indicator parameters, and selected organic priority pollutant and Hazardous Substances List (HSL) compounds. The specific list of metals and organic compounds to be monitored would be determined by U.S. EPA in cooperation with OEPA. Sediment and surface water monitoring would also be aimed at triggering appropriate responses if releases increase in the future.

Fencing requires routine maintenance for prolonged useful life. Monitoring would be effective in detecting water quality changes and identifying the need for future protective response actions, as appropriate.

AA-2 addresses current and future exposure risks. However, AA-2 is similar to no action in that the substantial threat of release of contaminants that may present an imminent and substantial danger to public health and welfare and the environment would remain. There is reasonable evidence that there are substantial quantities of uncontrolled hazardous substances and pollutants remaining in the waste mass. These substances could pose a threat to public health if released and public exposure occurs.

AA-2 has no major O + M requirements for process or structural performance. Fencing would require routine O + M.

AA-2 would not meet applicable State solid waste landfill closure regulations.

Alternative 3 (AA-3) consists of soil filling and grading with topsoil and revegetation at the site. AA-3 also includes the same deed restrictions and site fencing included with AA-2. Groundwater, surface water and sediment would be monitored regularly.

Filling and grading the site would effectively reduce the possibility of direct contact with the landfill waste mass. Soil cover and grading would reduce the infiltration percolation through the waste mass and, therefore, reduce the transport of contaminants. Deed restrictions and fencing would support and strengthen the effectiveness of the soil cover in limiting direct contact.

The site cover and grade require regular maintenance to remain protective. The useful life of the site cover would depend on proper O+M to maintain the finished grades against the effects of erosion and settlement. With proper O+M, the protectiveness of the cover should last indefinitely.

Routine monitoring of groundwater, surface water, and sediment would be effective in identifying changes in contaminant concentrations and causes for possible future protective response actions. Monitoring of groundwater is important to periodically check the effectiveness of the site cover installed.

Alternative 3 would not meet applicable State solid waste landfill closure regulations.

The Chosen Alternative consists of a 2 foot low permeability soil cap of the landfill, with a top soil cover and revegetation. This alternative also includes the deed restrictions, fencing, filling and grading and the monitoring program incorporated into AA-3. During Remedial Design (RD) the system would be evaluated for the need to include gas collection and venting, leachate/groundwater collection and disposal, and a drainage layer. Capping would effectively reduce the possibility of direct contact with the landfill contents. The cap would substantially reduce contamination transport caused by percolation of infiltration through the waste mass. Deed restrictions and fencing would support and strengthen the protectiveness of the capping in limiting direct contact.

The site cap would require regular maintenance to remain protective. The useful life of the site cap would depend on proper O+M, the protectiveness of the cap should last indefinitely.

Routine monitoring of groundwater, surface water, and sediment will be effective in identifying changes in contamination concentrations and causes for possible future protective response actions. Monitoring of groundwater is important to periodically check the effectiveness of the capping system installed.

The chosen alternative would meet all State solid waste landfill closure regulations, as well as all other applicable or relevant and appropriate requirements (ARARs).

Alternative 4 (AA-4) consists of a comprehensive capping of the landfill property. The capping system used as the basis for the cost estimate of AA-4 was a clay, soil and sand system, which would include gas collection and venting and leachate/groundwater collection and disposal. AA-4 also includes deed restrictions, fencing, filling and grading, and the monitoring program incorporated into AA-3.

Capping would effectively reduce the possibility of direct contact with the landfill contents. The cap would substantially reduce contaminant transport caused by percolation of infiltration through the waste mass. Deed restrictions and fencing would support and strengthen the protectiveness of capping in limiting direct contact.

The site cap would require regular maintenance to remain protective. The useful life of the site cap would depend on proper O+M, the protectiveness of the cap should last indefinitely.

Routine monitoring of groundwater, surface water, and sediment is effective in identifying changes in contaminant concentrations and causes for possible future protective response actions. Monitoring of groundwater is important to periodically check the effectiveness of the capping system installed.

AA-4 also incorporates a landfill gas venting/collection system to prevent gas accumulation under the cap and a leachate collection system at the toe of the slope to prevent fluid pressure from building up under the cap and to control releases of potentially contaminated leachate/groundwater. Both the gas and leachate collection systems would be periodically monitored to determine the need for possible future protective response actions such as treatment additions or modifications.

Alternative 4 would meet all ARARs.

Alternative 5 (AA-5) consists of capping with a multilayer cap system incorporating a synthetic membrane as typically used for RCRA closure at an existing facility. The capping system used as the basis for the cost estimate of AA-5 was soil, synthetic membrane, and clay. AA-5 also includes deed restrictions, fencing, filling and grading and the monitoring program incorporated into AA-3 and AA-4.

Capping would effectively reduce the possibility of direct contact with the landfill contents. The membrane cap system would substantially reduce contaminant transport caused by percolation of infiltration through the waste mass. Deed restrictions would support and strengthen the protectiveness of capping in limiting direct contact.

The site cap will require regular maintenance to remain protective. The useful life of the site cap would depend on proper O+M. With proper O+M, the protectiveness of the cap should last indefinitely.

Routine monitoring of groundwater, surface water, and sediment would be very effective in identifying changes in contaminant concentrations and causes for possible future protective response actions. Monitoring of groundwater is important to periodically check the effectiveness of the capping system installed.

AA-5 also incorporates the same gas vent and leachate collection systems as AA-4. Both the gas vent and leachate collection systems would be periodically monitored to determine the need for possible future protective response actions such as treatment.

AA-5 would meet all ARAR's.

IX. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A. Overall protection of human health and the environment.

Alternative 1 would not be effective in protecting either human health or the environment.

Alternative 2 would provide some protection from direct contact through fencing and disturbance of the subsurface through deed restriction.

Alternative 3 would provide protection from direct contact and would help prevent groundwater and surface water contamination.

The chosen alternative, alternative 4 and alternative 5 would provide increasing protection from direct contact, groundwater and surface water contamination.

B. Compliance with ARARs.

SARA requires that remedial actions meet legally applicable or relevant and appropriate requirements of other environmental laws. These laws may include: the Toxic Substances Control Act, the Safe Drinking Water Act, the Clean Air Act, the Clean Water Act, the Solid Waste Disposal Act (RCRA), and any state law which has stricter requirements that the corresponding federal law.

Applicable requirements are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site. A requirement is "applicable" if the remedial action or circumstances at the site satisfy all of the jurisdictional prerequisites of the requirement.

Relevant and appropriate requirements are cleanup standards, standards of control, and other environmental protection requirements, criteria or limitations promulgated under Federal or State law that, while not legally "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to that site.

"A requirement that is judged to be relevant and appropriate must be complied with to the same degree as if it were applicable. However, there is more discretion in this determination: it is possible for only part of a requirement to be considered relevant and appropriate, the rest being dismissed if judged not to be relevant and appropriate in a given case" (Interim Guidance on Compliance with Applicable or Relevant and Appropriate Requirements, 52 FR 32496, August 27, 1987).

1. Landfill Closure Requirements

The regulations promulgated pursuant to the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Sections 6901, et. seq., are not "applicable" to this site. The RCRA regulations which govern Hazardous Waste Treatment, Storage and Disposal facilities (40 CFR Parts 264 and 265) did not become effective until November 19, 1980. The Coshocton Landfill ceased accepting wastes prior to that date.

Those RCRA regulations addressing solid waste disposal activities (40 CFR Parts 241 and 256, primarily) do not have direct application to individual facilities but rather provide for an enforcement program to be administered by the states pursuant to a Solid Waste Management Plan.

Though RCRA regulations are not jurisdictionally applicable to the remediation of the site, they are certainly "relevant" to the actions occurring thereon. Both subtitle C of RCRA, which applies to hazardous waste activities and facilities, and subtitle D of RCRA, which applies to Solid Waste Facilities, have a logical bearing upon a landfill which contains both hazardous and solid waste materials.

Though both Subtitle C and Subtitle D are relevant to the remedy for the Coshocton Landfill, the Subtitle D provisions relating to capping/covering the landfill are deemed more appropriate. (None of the alternatives under consideration involve excavation, physical redistribution or treatment of the waste so as to make those subtitle C regulations which are applicable to "management" of waste). The appropriateness determination is dependent on whether substantive requirements are meant to address sufficiently similar circumstances as those present at the specific site to make them particularly well suited to that site. It is, of necessity, a case by case determination relying on the opinions and judgment of experts, as well as on objective information and evidence.

The following factors were considered in reaching a conclusion that the Subtitle C capping/cover requirements are not appropriate for this site:

1. Estimated proportion of reported hazardous substances to total landfill waste.

2. General toxicity and mobility of the reported hazardous substances constituents.

3. Results of the endangerment assessment.

Estimated Hazardous Substances Proportion. The proportion or fraction of reported hazardous substances to total landfill wastes was estimated. The estimate was based on calculated landfill volume, reported wastes disposed by six major local industries (assumed to be hazardous based on the descriptions given in the CERCLA Section 104(e) responses) and estimated densities for the landfill materials and hazardous substances.

The estimated proportion ranged from 0.7 to 1.3 percent with an estimated maximum fraction of 2.4 percent by weight. This range and maximum were calculated by adjusting assumptions on the variables in the estimates.

General Toxicity and Mobility. The industrial wastes considered hazardous were mostly described as spent chlorinated solvents, waste dirty oil, paint sludges including cleaning solvents and caustic sludges. Many of these wastes would now be listed "F wastes" or meet the RCRA definition of ignitible, i.e., characteristic hazardous wastes.

The spent chlorinated solvents included trichloroethylene (TCE) and methylene chloride. Both solvents are relatively mobile in groundwater. TCE has a MCL of 5 ppb (ug/L) and a MCLG of 0 ppb (ug/L) based on suspected carcinogenicity.

The other flammable solvents (including mineral spirits, xylene, toluene and methyl ethyl ketone) are considered mobile and are not suspected carcinogens and have relatively low toxicity compared with some of the chlorinated solvents.

Paint sludges and caustic cleaning sludges are relatively immobile. Some leaching of heavy metals could be expected but this would tend to occur relatively slowly as the paint sludges deteriorate.

Results of the Endangerment Assessment. The endangerment assessment did not ~~find~~ a pattern of release from the landfill that was causing current unacceptable risks to human health or the environment.

In summary, Subtitle C landfill closure requirements are not deemed appropriate for the following reasons:

a. The majority of total wastes deposited was general municipal garbage, industrial refuse and inert yard-type trash (tree stumps and demolition debris). The estimated fraction of drummed hazardous substances was less than 2.5 percent by weight.

b. Some of the specific hazardous substances are suspected carcinogens, however, most of the reported hazardous substances were relatively low toxicity flammable materials.

c. The site does not show a pattern of hazardous substance release causing a demonstrated risk to human health or the environment based on the endangerment assessment.

However, Subtitle D provisions are deemed appropriate to that portion of the chosen remedy requiring that the site be covered to protect against direct contact with the waste and to minimize the production of leachate and discharges to ground and surface water. Said provisions are embodied as "Guidelines" at 40 CFR Part 241. In order to meet the requirement of section 241.209-1 that cover material be applied "to minimize fire hazards, infiltration of precipitation...", section 241.209-3 recommends that "the thickness of the compacted final cover should not be less than 2 feet".

It should be noted that the subtitle D guidelines were enacted in 1974 and that amendments reflecting experience gained in the intervening years are anticipated in the near future. Moreover, the existing guidelines assume the landfill wastes to be that generated by residential and commercial sources. They advise that "If techniques other than the recommended procedures are used, or wastes other than municipal solid wastes are disposed, it is the obligation of the proposed facility's owner and operator to demonstrate to the responsible agency in advance by means of engineering calculations and data that the techniques employed will satisfy the requirements". 40 CFR 241.100(b)

As a part of the public comment process, a group of PRPs has proposed an alternate remedy for the site. To the extent such alternate remedy may be considered, Subtitle D indicates that engineering calculations and data should be provided which demonstrate that such alternative will as effectively minimize infiltration of precipitation as the recommended procedures.

There are no "applicable" state hazardous waste regulations since no hazardous materials were disposed of in the landfill subsequent to the promulgation of the Ohio Hazardous Waste Management regulations in 1981. For the reasons enunciated previously in the discussion of the appropriateness of Subtitle C and Subtitle D of RCRA, the state's hazardous waste regulations are not addressed to circumstances sufficiently similar to these site conditions to make them "appropriate".

However, the State of Ohio does have Solid Waste Disposal Regulations (Ohio Administrative Code, Chapter 3745) which are applicable to this site, and which were identified in a timely manner. (See correspondence from Ohio EPA to U.S. EPA dated August 18, 1987, November 5, 1987, and March 16, 1988). The regulations were adopted on July 29, 1976 and were in effect during times when the Coshocton Landfill was in operation. Moreover, correspondence obtained from state records indicates that said landfill has never been properly closed pursuant to the Ohio regulations, specifically section 3745-27-10.

The chosen alternative is intended to be consistent with the State Solid Waste regulations. The PRP group has proposed an alternate remedy, as a part of the public comment process, which on its face does not appear to satisfy the State regulations. However, the State regulations contemplate a waiver of specific regulatory provisions if an applicant demonstrates that under specific terms and conditions the facility will not harm the public health or the environment, OAC § 3745-27-11. If during the remedial design stage or during consent decree negotiations the PRP group demonstrates that an alternate closure design would satisfy the requirements of such a waiver under state solid waste regulations, U.S. EPA may consider modifying the chosen remedy, if it determines that such an alternate plan is equally protective.

2. Other Requirements

If a leachate collection system and/or a gas venting system is determined to be necessary during the design process, applicable and relevant and appropriate standards will be complied with for all systems. These may include the following:

Law, Regulation or Standard	Source of Regulation
Safe Drinking Water Act Maximum Contaminant Limits (MCL's)	Safe Drinking Water Act, 40 CFR 141 through 143
Intergovernme National Pollutant Discharge Elimination System (NPDES) Permit	CWA Section 402, 40 CFR 122, 123, 125 Subchapter N
Pretreatment Regulations for Existing and New Sources of Pollution	40 CFR 403 Subchapter N, FWPCA
Occupational Safety and Health Act (OSHA)	29 CFR 1910
STATE	
Ohio NPDES Permit	OAC 3745-31-05 (A) (3)
Ohio NPDES Regulations	Ohio Administrative Code: 3745-33-01 through 3745-33-10. Authority granted by Ohio Water Pollution Control Act, ORC 6111.03.
Ohio Water Quality Standards	Ohio Administrative Code: 3745-1. Authority granted by Ohio Water Pollution Control Act, ORC 6111.041.
Ohio Pretreatment Regulations	Ohio Administrative Code: 3745-3. Authority granted by Ohio Water Pollution Control Act, ORC 6111.03.
Ohio Water Pollution Control Act	Ohio Revised Code: 6111.01 to 6111.08.

Law, Regulation, or Standard	Source of Regulation
Ohio General and Miscellaneous Air Pollution Regulations	Ohio Administrative Code: 3745-15-04.
	Ohio Administrative Code: 3745-15-07.
	Ohio administrative Code: 3745-15-08.
Ohio Air Pollution Control Laws	Ohio Revised Code: 3704.03.
Ohio regulation on Air Permits to Operate and Variances	Ohio Administrative Code: 3745-35

C. Long-term effectiveness and permanence

Alternative 1 would not be effective in addressing contamination from the site.

Alternative 2 would provide only limited long term effectiveness and would require long-term care of the fence.

Alternative 3, the chosen alternative, and alternatives 4 and 5 would provide increasing effectiveness as the quality of the cap is improved.

All would require long-term maintenance in order to retain their effectiveness.

D. Reduction of toxicity, mobility or volume

None of the alternatives will reduce the toxicity or volume of the wastes at the site because all landfill waste will remain in place.

Alternative 1 and 2 will have no effect on the mobility of the wastes.

Alternative 3, the chosen alternative, and alternatives 4 and 5 are all designed to reduce the mobility of the wastes. As the quality of the cap is improved in moving from the alternative 3 to alternative 5 the reduction in mobility becomes more effective.

Water Balance calculations by assembled alternative

Alternative	Runoff (in/yr)	Percolation (in/yr)
No action AA-1 and AA-2	6.1	21.3
Surface Controls AA-3	10.1	4.3
Chosen Alternative	10.1	2.2
Soil-Clay Cap AA-4	10.1	2.2
Soil-Membrane-Clay Cap AA-5	10.1	0.3

E. Short-term effectiveness

Alternative 1 would not be effective in addressing contamination from the site.

Alternative 2 would help restrict access to the site once the fence is completed. It would also monitor conditions at the site.

Alternative 3, the chosen alternative, and alternatives 4 and 5 would cause short term impacts due to construction of the cap. These would include noise from heavy equipment, dust and increased chances for direct contact with wastes by construction personnel.

F. Implementability

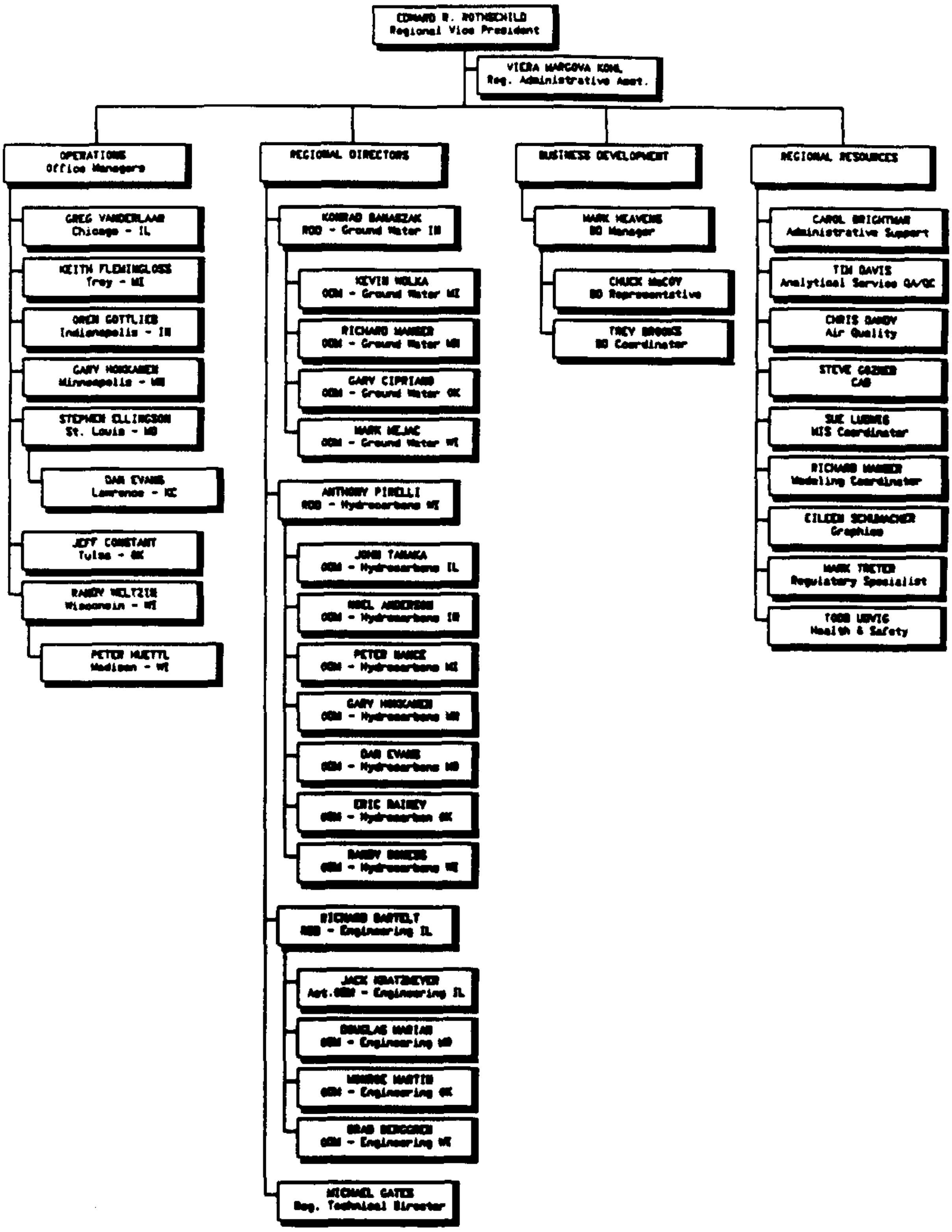
All of the alternatives are readily implementable. The chosen alternative, and alternatives 3, 4 and 5 utilize proven techniques for capping the landfill. The leachate collection and gas venting techniques used for alternatives 4 and 5 and potentially the chosen alternative are also commonly used and proven techniques.

G. Cost

COST ESTIMATE SUMMARY

AA-1 No action (Cost estimates not applicable)
AA-2 Site Re[illegible]ictions
AA-3 Site Gra[illegible]ing

MIDWEST REGION FUNCTIONAL STRUCTURE
MAY 14, 1991



Chosen Alternative Soil and Clay Capping
AA-4 Soil and Clay Capping
AA-5 Soil, Synthetic Membrane, and Clay Capping

Description	AA-2	AA-3	Chosen Alternative	AA-4	AA-5
Sitework	$0	$3,800,000	$2,850,000	$6,190,000	$6,190,000
Clay Barrier	$0	$0	$2,060,000	$2,060,000	$2,060,000
Geomembrane	$0	$0	$0	$0	$1,250,000
Leachate/Groundwater Collection Storage and Treatment	$0	$0	$0	$475,000*	$475,000
Gas Collection	$0	$0	$0	$374,000*	$374,000
Health and Safety	$0	$23,000	$46,000	$46,000	$57,000
Deed Restriction/ Fencing	$176,000	$176,000	$176,000	$176,000	$176,000
Design, Contingencies and Other Costs	$251,000	$3,080,000	$2,880,000	$6,950,000	$7,800,000
Total Capital Cost Estimate	$427,000	$7,080,000	$8,010,000	$16,300,000	$18,400,000
Annual O + M Cost Estimates	$69,500	$82,000	$96,000	$129,000	$129,000
O + M Present Worth (10% interest, 30-yr)	$655,000	$773,[illegible]0	$910,000	$1,220,000	$1,220,000
Total Present Worth	$1,080,000	$7,850,000	$8,920,000	$17,500,000	$19,600,000

* These items are potentially included with the cost estimate for the chosen alternative if determined to be necessary by OEPA during the design.

H. Support Agency Acceptance

The Ohio EPA has indicated that it fully supports the chosen remedial alternative. A letter from the director of the Agency indicating this support is attached.

I. Community Acceptance

The community appears to be divided on the benefits to be derived from a protective remedy. Because the City of Coshocton is one of the PRPs, many of the taxpayers in the City oppose the expenditure of the funds required for alternative 4. The citizens of Coshocton do not feel that the threat identified in the Endangement Assessment supports the expenditure of substantial amounts of city tax money. The people who live near the landfill, however, are strongly in favor of a protective remedy, whatever the cost.

X. SELECTED REMEDY

The selected remedy has the following major components:

- Complete site fencing and posting
- Recordation of Notice in the chain of title designating the site as a restricted use property, used to manage hazardous waste
- Site grading to promote precipitation runoff and reduce infiltration
- Site capping which meets State solid waste landfill requirements and which minimizes leachate generation and prevents direct contact with contaminated materials
- Top cover of topsoil and revegatation
- Monitoring of groundwater, surface water and landfill gas to determine effectiveness of above measures and to provide early alert as to the need for other actions

The following components will be evaluated during the Remedial Design (RD) and will be included if required:

- Landfill gas collection and venting system

- Leachate and groundwater collection and on-site system with facilities for truck loading

- Provisions for on-site or off-site treatment and disposal of collected leachate and groundwater at a local POTW or on site treatment

XI. STATUTORY DETERMINATIONS

A. Protection of Human Health and the Environment

The remedy selected is based on potential future endangerment to public health, welfare and the environment. Site file records provide reasonable evidence that substantial quantities of hazardous substances and pollutants exist in the landfill waste mass. The substantial threat of release of these materials may present an imminent and substantial danger to public health, welfare and the environment if these substances were released and public exposure occurred.

The chosen alternative is protective of human health and the environment. The fencing, deed restrictions and capping all provide protection from direct contact with contaminated materials. Capping of the landfill also reduces the percolation through the landfill and thus the migration of hazardous substances into groundwater and surface water. Monitoring of the groundwater and surface water will identify any failures of the containment system installed at the landfill. Once alerted to an elevated level of contaminants, additional corrective actions can be taken to abate any threat.

B. Attainment of Applicable or Relevant and Appropriate Requirements

The U.S. EPA's selection of site capping and related facilities for the Coshocton Landfill is intended to comply with applicable state solid waste landfill regulations.

The selected remedial alternative would also comply with specific public health and environmental requirements. These ARARs are called "chemical-specific" requirements. Public health and environmental ARARs expressed as chemical-specific limits or requirements would be addressed as follows:

° Routine monitoring of groundwater at the site to check for migration of releases into groundwater, surface water and gas.

If a need is indicated during design for these actions, the following actions may also be taken:

° Leachate/groundwater treatment at a local POTW;

° Routine monitoring of collected leachate/groundwater to determine loading to the POTW.

C. Cost-effectiveness

The selected remedy is prescribed by compliance with solid waste landfill closure ARARs. The range of alternative actions to meet closure requirements is very limited. Therefore, the chosen alternative is essentially cost-effective because it is the least expensive alternative which satisfies said regulations. Cost-effectiveness of the chosen alternative is established relative to alternatives AA-4 and AA-5 which would cost more without increasing the degree of compliance with ARARs.

The actual cost of implementing the remedial action is expected to be different than the order-of-magnitude cost estimate prepared in the feasibility study (FS). During design, some construction details may be developed to produce a closure system that will be lower in cost than the order-of-magnitude FS estimate. Conversely, factors may cause the cost to be higher than the estimate. The final implementation cost is expected to fall within the range of accuracy expected for the order-of-magnitude estimate developed.

D. Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

SARA mandates a preference for the selection of permanent remedies that completely or probably produce a "....permanent and significant decrease in the toxicity, mobility or volume of the hazardous substance, pollutant or contaminant."

SARA also specifies that the selected remedial action must use "... permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable". If the selected remedial action is not appropriate for the permanence and treatment preferences cited above, an explanation of why a remedial action not incorporating these features was selected is required.

A permanent remedy involving treatment or recovery technologies was not selected for the Coshocton Landfill. Permanent remedies using thermal oxidation treatment technologies were evaluated and were judged to be not practicable for the Coshocton Landfill site. Application of treatment at the Coshocton Landfill would be impracticable for the following reasons:

- Hazardous substances were apparently placed haphazardly within the landfill waste mass during operation. Segregation of hazardous from non-hazardous waste would be impractical. Therefore treatment would be required for the entire waste mass. This was considered: 1) not technically practicable, 2) not prudent because of the potentially greater risk to human health and environment caused by excavation.

- The estimated cost of thermal treatment would be extremely high and require many years to complete.

- Full ARAR compliance would be achieved by landfill closure which would be protective of human health and cost effective.

RECORD OF DECISION SUMMARY

BOWERS LANDFILL

CIRCLEVILLE, OHIO

March 24, 1989

U.S. Environmental Protection Agency

Region V

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BOWERS LANDFILL
CIRCLEVILLE, OHIO

1.0 SITE NAME, LOCATION, AND DESCRIPTION

Bowers Landfill is located in rural Pickaway County, Ohio, approximately 2.5 miles north of the City of Circleville. The site is just northwest of the intersection of Island Road and Circleville - Florence Chapel Road, on the east side of the Scioto River Valley. The landfill lies within the Scioto River floodplain. Its northwestern and southern-most points abut the Scioto River (Figure 1).

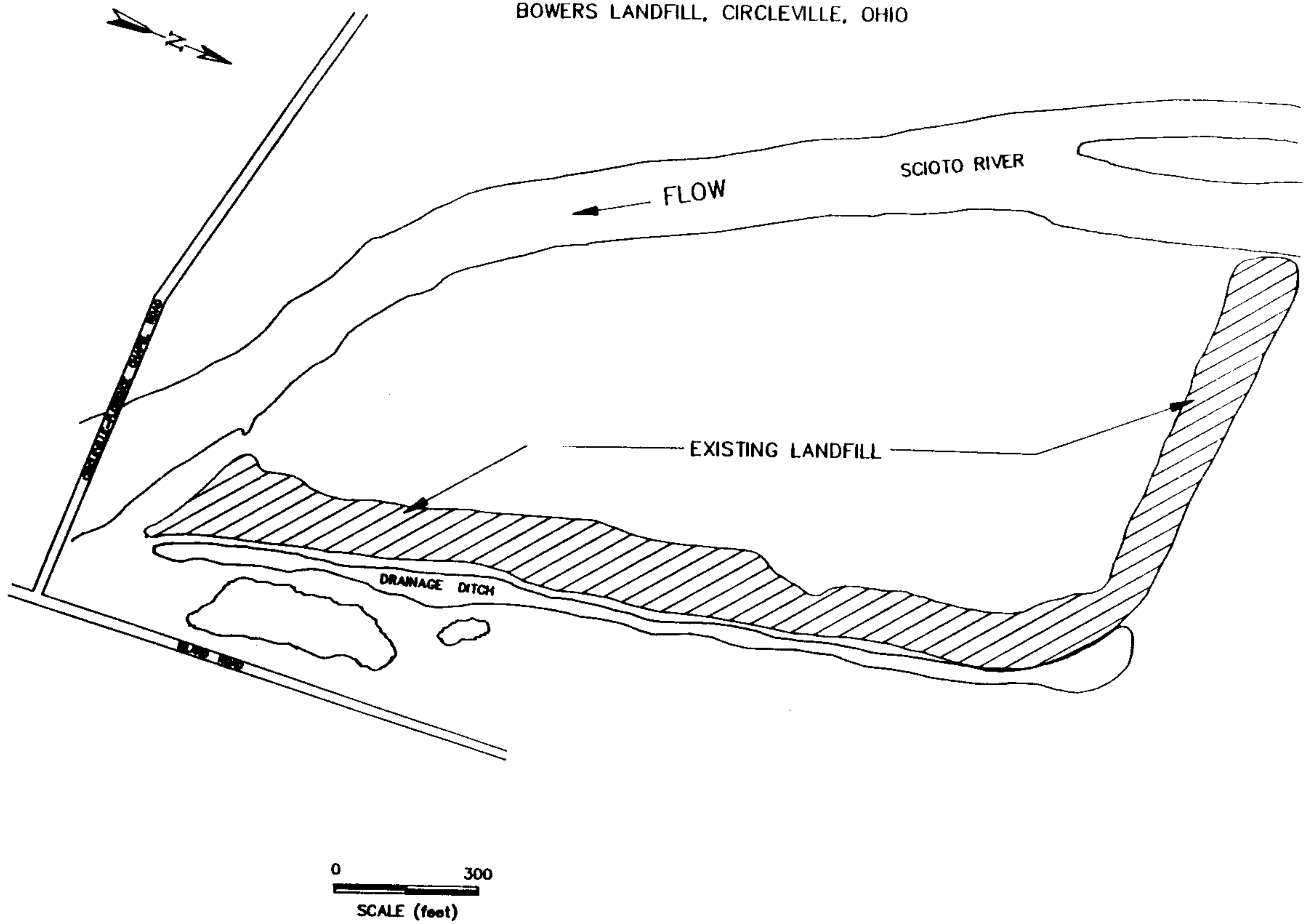
The landfill occupies about 12 acres of a 202-acre tract owned by the estate of Dr. John M. Bowers. The landfill was constructed as a berm approximately 4,000 feet long with an average width of 125 feet and a top height of approximately 10 feet above grade. The reported waste volume of the landfill is approximately 130,000 cubic yards. The landfill has an established cover of vegetation, including small trees, but miscellaneous debris is exposed where the landfill surface has been eroded. The area east of the site is a natural topographic high with the elevation on Island Road about 50 feet higher than the landfill. This topography has been modified by quarrying activities to the east and northeast of the site. The north and west sides of the landfill are bordered by agricultural fields.

Since the landfill lies within the Scioto River floodplain, it is flooded regularly. The field west of the landfill is inundated an average of 29 days per year, and parts of the landfill are overtopped by flood waters an average of every 2 years. Flood waters and precipitation generally flow west and south toward the Scioto River. A drainage ditch lies immediately east of the landfill. Water in this ditch flows through a pipe under the southern end of the landfill and discharges to the Scioto River. A ditch on the west side of the landfill is not well developed and does not discharge to the river. Water in this ditch tends to pond near the southern end of the landfill.

The site area is rural, with 15 houses located within a ½-mile radius of the landfill. Houses in this area largely depend on private wells for water supply. However, no downgradient wells are within 1 mile of the site. The City of Circleville's water supply wells are located about 1-1/2 miles south of the site.

A more complete description of the site can be found in the Remedial Investigation Report (dated August 22, 1988) and the Feasibility Study Report (dated February 3, 1989).

FIGURE 1
BOWERS LANDFILL, CIRCLEVILLE, OHIO



2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Dr. Bowers began operating the landfill in 1958. Little information is available on the types and quantities of wastes disposed of at Bowers Landfill. Much of the information was supplied by interviews with individuals familiar with landfill operations. However, these interviews were conducted 15 to 20 years after site operations ended. Information from Ohio EPA (OEPA) files indicates that residential type waste, collected by private haulers in and around Circleville, accounts for most of the material in Bowers Landfill. No industrial dumping at the site was reported before 1963. Between 1963 and 1968, in addition to general domestic and industrial refuse, the site received chemical wastes originating from local industries, including E.I. DuPont deNemours & Company (DuPont) and Pittsburgh Plate Glass, Inc. (now PPG Industries, Inc.). DuPont and PPG reported sending 6,000 and 1,700 tons of waste, respectively, to Bowers Landfill between 1965 and 1968.

Waste disposal practices consisted largely of dumping waste directly onto the ground and covering it with soil. However, there are some indications that the southern part of the landfill may have been excavated for waste disposal. Waste was also burned at the site; the extent and dates of waste burning are not known. Landfilling at the site ended around 1968. The site was not secured when landfilling ended, and the cover material of sand, gravel, and some topsoil was characterized as "not sufficient" during a 1971 inspection by the Pickaway County Health Department.

In 1980, U.S. EPA collected and analyzed surface water samples from the site area; the results indicated that some contaminants were being released from the landfill. U.S. EPA subsequently required Dr. Bowers to commission an environmental study of the site. During the study, three wells were installed to monitor ground-water quality. These and a number of existing private wells and surface water points near the site were sampled. Volatile organic compounds (VOC), including ethylbenzene, toluene, and xylene, were found in downgradient monitoring wells immediately west of the site. However, no VOCs were detected in an upgradient well east of the site.

In 1982, based on the levels of organic contaminants measured in water samples from the site, Ohio EPA (OEPA) requested that the site be placed on the National Priorities List (NPL) as a Superfund site. In 1985, U.S. EPA and OEPA signed a consent order with DuPont and PPG, two of the potentially responsible parties (PRP). This order outlined the scope and schedule for a remedial investigation (RI) and feasibility study (FS) at Bowers Landfill. DuPont and PPG have assumed responsibility for the site investigation. Dames & Moore, under contract to the PRPs, conducted the RI and FS.

RI field activities began in July 1986 and included two phases, a first phase to characterize contaminant levels at the site and a second phase to answer questions raised by the first phase. During the first phase, 18 monitoring wells were installed at or near the landfill and sampled twice. Ground water from four off-site residential wells was sampled once. Sediment and surface water were sampled twice, and surficial soils were sampled once. This first phase of sampling was completed in May 1987. The second phase of the RI was conducted during February and March 1988. The major purposes of the second phase were (1) to assess ground-water flow direction in the deeper of the two aquifers that underlie the site and (2) to collect additional ground-water and soil samples. Two additional monitoring wells were installed during the second phase, and five wells (including the two new wells) were sampled. In addition, soil samples were collected from 10 locations. Dames & Moore prepared a Remedial Investigation Report (dated August 22, 1988) describing these activities.

Dames & Moore began the FS in early 1988. The FS was based on the results from the RI and also on the results of an endangerment assessment (EA) prepared by a U.S. EPA contractor. Nine remedial alternatives for Bowers Landfill, including the "no action" alternative, were evaluated in the FS. Dames & Moore prepared a Feasibility Study Report (dated February 3, 1989) to describe the development and evaluation of these alternatives.

Following completion of the RI and FS, U.S. EPA sent a special notice letter to the PRPs on March 1, 1989. This letter indicates U.S. EPA's willingness to allow the PRPs to carry out the design and implementation of U.S. EPA's preferred remedial alternative for Bowers Landfill. During the FS process, both U.S. EPA and OEPA reviewed the PRPs' preference for a remedial alternative. However, for reasons outlined in this decision summary, U.S. EPA has selected a different alternative. Technical discussions between the agencies and the PRPs, concerning the selection of a remedial alternative, are summarized in the Administrative Record for Bowers Landfill.

3.0 COMMUNITY RELATIONS HISTORY

U.S. EPA has conducted an extensive community relations program in conjunction with the Bowers Landfill RI/FS. Between November 7, 1985, and November 2, 1988, 12 meetings of the Bowers Landfill Information Committee were held in Circleville, Ohio. The Information Committee consists of representatives from U.S. EPA, OEPA, the PRPs, local (city and county) government, and citizens' groups. These meetings were held at regular intervals to keep the public informed of progress during the RI/FS and to discuss upcoming events. During the meetings, U.S. EPA, OEPA, and the PRPs made formal presentations to the committee on topics such as well installation and sampling methods; sampling results for soil, ground water, surface water, and sediment; endangerment assessment results; applicable or relevant and appropriate requirements (ARARs); and remedial alternatives developed in the FS. Following the presentations, U.S. EPA, OEPA, and the PRPs discussed these topics with the committee and answered questions from committee members.

As part of its community relations program, U.S. EPA has maintained an information repository at the Pickaway County District Library, 165 East Main Street, Circleville, Ohio. All formal reports submitted by the PRPs during the Bowers Landfill RI/FS are available at this location. The information repository also contains reports prepared by U.S. EPA, such as the Endangerment Assessment Report and Proposed Plan for Bowers Landfill.

On September 14, 1988, U.S. EPA held a formal public meeting to present the results of both the Remedial Investigation and Endangerment Assessment Reports. This meeting was held at the Circleville High School Cafeteria, 380 Clark Drive, Circleville, Ohio.

Finally, U.S. EPA notified the local community, by way of the Proposed Plan, of the preliminary selection of a remedial alternative for Bowers Landfill. To encourage public participation in the selection of a remedial alternative, U.S. EPA scheduled a public comment period from February 14 to March 16, 1989. Additionally, U.S. EPA held a public meeting on February 28, 1989, to discuss the preferred remedial alternative, other alternatives evaluated in the FS, and any other documents previously released to the public. A transcript of this meeting is included as part of the Administrative Record for Bowers Landfill. U.S. EPA's responses to comments received during this public meeting and to written comments received during the public comment period are included in the Responsiveness Summary.

4.0 SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The selected remedy for Bowers Landfill was developed by combining aspects of source control, site access restrictions, drainage improvements, and long-term monitoring. In summary, the selected remedy will include removing surface debris and vegetation from the landfill, installing a 4-foot-thick clay and soil cap on the landfill top and side slopes, instituting erosion control and drainage improvements, fencing the site perimeter and restricting site use, and conducting long-term ground-water monitoring. The components of the selected remedy are described in greater detail in Section 10.0.

The principal threats that the landfill poses are exposure to ground water immediately downgradient of the site and exposure to contaminated soils on or near the landfill. The selected remedy will address these threats by capping contaminated soils, limiting access to the landfill area, and restricting future ground-water use between the landfill and the Scioto River. Because wastes will remain on-site, the selected remedy will provide for long-term monitoring and corrective action measures should monitoring indicate increased contamination or threats. Also, as required by Section 121(c) of CERCLA, the site will be reevaluated each 5 years to determine whether the selected remedy is effective.

5.0 SITE CHARACTERISTICS

The remedial investigation (RI), consisting of on-site scientific studies and laboratory analyses to determine the nature and extent of contamination at the site, has been completed. The first phase investigation took place from July 1986 to May 1987. A second phase investigation was conducted in February and March 1988. During the RI, samples were taken of ground water, surface water, sediment, and soil. The results of the RI are summarized below.

5.1 Ground Water

The Bowers Landfill site is underlain by 40 to 100 feet of glacial deposits, which overlie shale bedrock. These glacial deposits are part of an extensive aquifer system that underlies the Scioto River floodplain. In the site area, glacial deposits thicken to the south and west of the site, and are thinnest at the northeast portion of the landfill. The glacial deposits include two water-bearing zones -- (1) a brown sand and gravel deposit that lies approximately 10 feet below the land surface and (2) a gray sand deposit with lesser amounts of gravel that lies just above the bedrock. These two zones are considered the upper and lower aquifers over most of the site and are separated by a low-permeability silt-clay deposit. However, the two aquifers may be hydraulically connected at some site locations. The bedrock below the glacial deposits is considered an aquiclude and is not used locally for water supply. Figure 2 illustrates an east-to-west geologic-cross section of the site area.

Dames and Moore installed 20 ground-water monitoring wells at the site. These included 10 shallow wells, 5 intermediate wells, and 5 deep wells (Figure 3). Shallow wells were screened at the water table near the top of the upper aquifer. Intermediate wells were screened within the lower portion of the upper aquifer. Deep wells were screened within the lower aquifer. A comparison of ground-water levels for each series of wells (shallow, intermediate, and deep) indicated that ground water near the site is moving west or southwest.

FIGURE 2

GEOLOGIC CROSS-SECTION OF THE SITE AREA

BOWERS LANDFILL – CIRCLEVILLE, OHIO

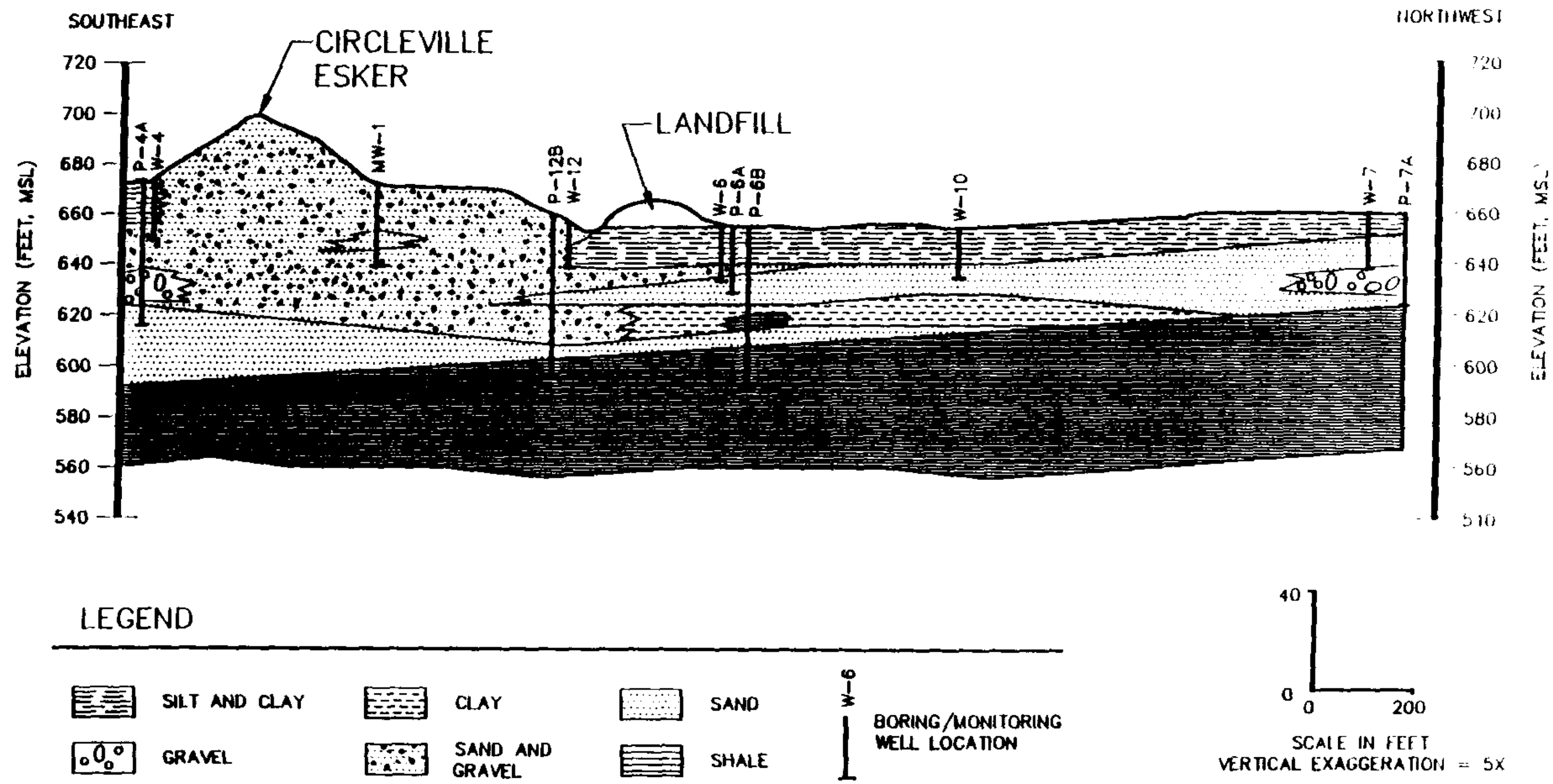
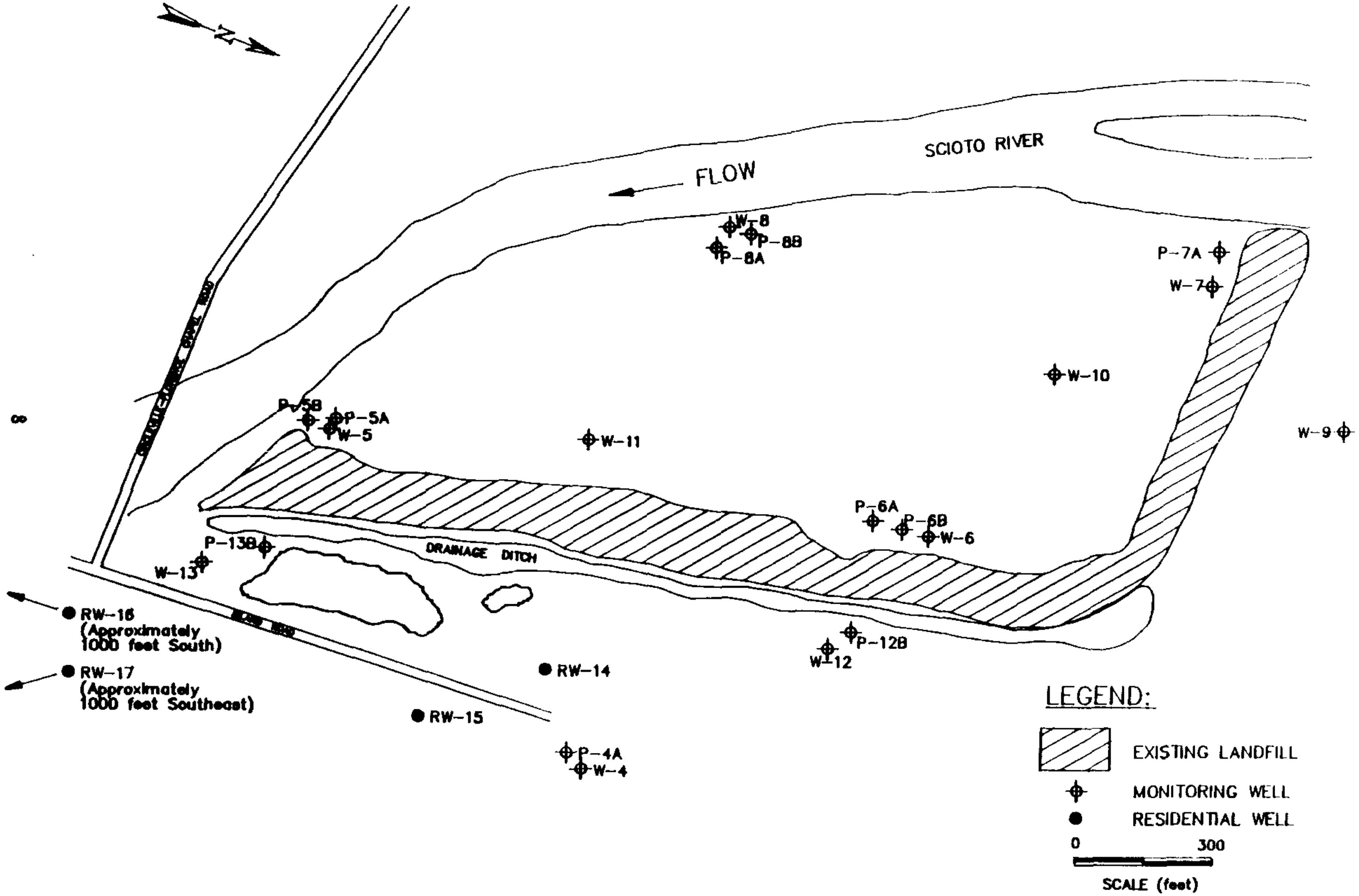


FIGURE 3. – LOCATIONS OF WELLS SAMPLED



Ground-water samples were collected from 18 monitoring wells in February 1987 and May 1987 (Figure 3). Samples were also collected from four residential wells in February 1987. Two additional monitoring wells were installed in February 1988. These wells and three of the original 18 wells were sampled in March 1988. All samples were analyzed for VOCs, semivolatile organic compounds (SVOC), pesticides, polychlorinated biphenyls (PCB), metals, and cyanide. Samples collected in February and May 1987 were also analyzed for dioxin.

VOCs including acetone, methylene chloride, tetrachloroethene, and benzene were detected at low concentrations in some ground-water samples taken from monitoring wells at or near the site. In all, 9 of the 20 monitoring wells contained VOCs in at least one sample. Most of these positive results were due to acetone and methylene chloride, common laboratory contaminants. Benzene and tetrachloroethene were found in one well each. Benzene was found in well P-6B, downgradient of the landfill, in two of three sampling rounds. The highest concentration detected was 6 μg/L, slightly above the U.S. EPA drinking water standard of 5 μg/L. Tetrachloroethene was found in upgradient well W-12 both times this well was sampled. The maximum concentration detected was 5.3 μg/L.

Bis(2-ethylhexyl)phthalate, a SVOC, was detected in several ground-water samples. Three other SVOCs, di-n-butyl phthalate, 2-methylnaphthalene, and n-nitrosodiphenylamine, were found in one sample each. All of these chemicals except one (bis(2-ethylhexyl)phthalate at 21 μg/L in well P-7A) were identified at levels below U.S. EPA-specified detection limits. No SVOCs were detected in residential well samples.

A number of metals were also detected in ground-water monitoring and residential wells. All levels except those for barium were below U.S. EPA drinking water standards. Barium was detected above drinking water standards in all three samples collected from well P-5B. This well is screened in the lower aquifer near the south end of the site. Since barium was detected in all ground-water samples, including samples from residential wells, some portion of the barium found in well P-5B may be due to natural sources.

Residential wells do not appear to be affected by releases from the site. Methylene chloride, a common laboratory contaminant, was the only organic compound found in residential wells, and no metals were detected above drinking water standards. In addition, sampling results from the Circleville municipal well field, located 1-1/2 miles south of the landfill, show that the well field has not been affected by Bowers Landfill. Ground-water contamination resulting from the landfill appears to be confined to the area between the landfill and the Scioto River. The Scioto River is the likely discharge point of these contaminated ground waters. Thus, the impact of contaminated ground water appears limited.

5.2 Surface Water and Sediment

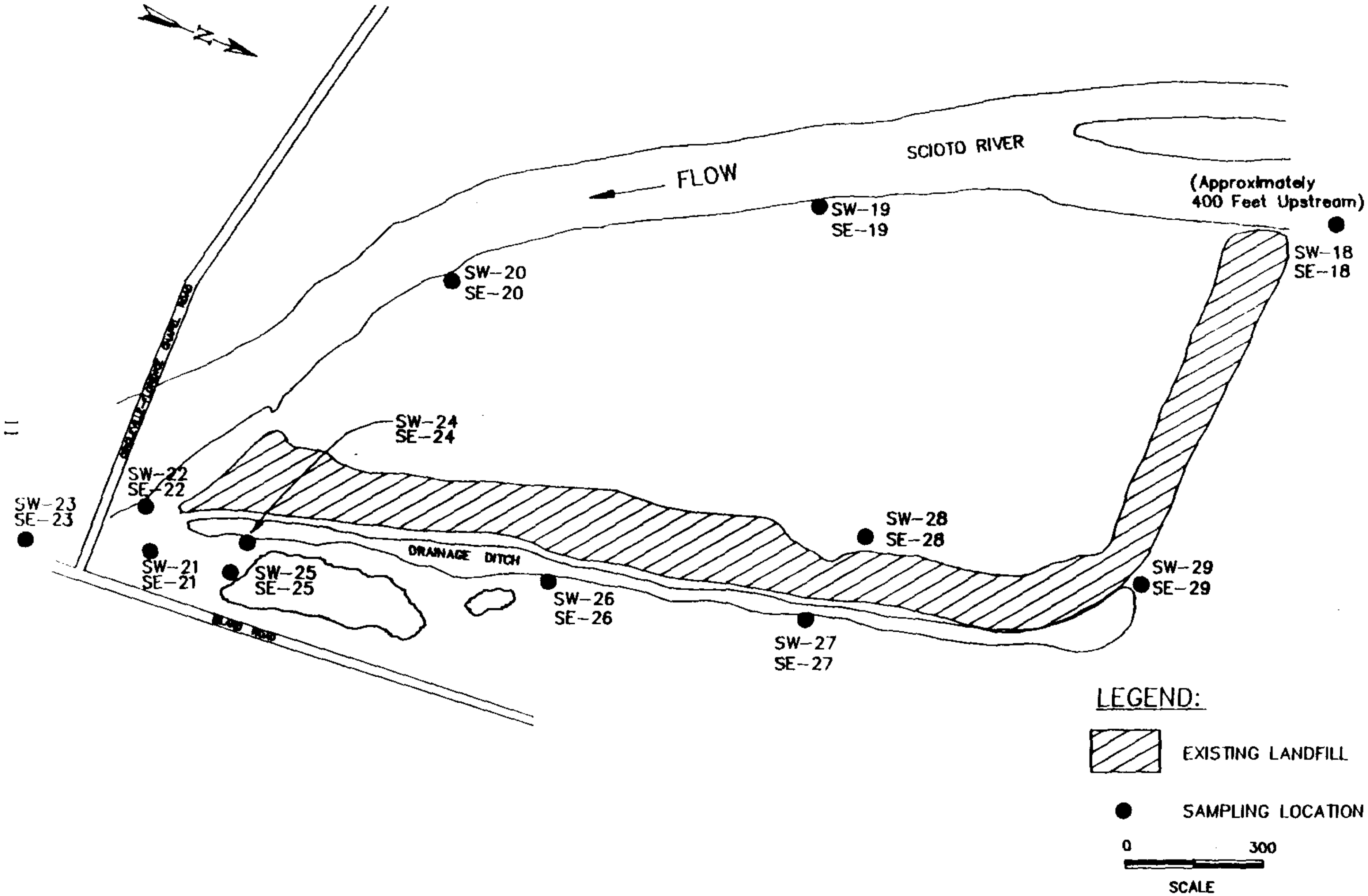
Surface water and sediment samples were collected from 12 locations in the Scioto River and nearby surface water bodies. These samples were analyzed for VOCs, SVOCs, pesticides, PCBs, metals, cyanide, and dioxin. Samples were collected from all locations shown on Figure 4 during two sampling events.

Methylene chloride (5 samples), tetrachloroethene (3 samples), and 1,2-dichloroethane (2 samples) were found at low levels (up to 5.7 μg/L) in the river downstream of the landfill or in drainage ditches near the landfill. However, methylene chloride and tetrachloroethene were found at similar concentrations in upstream background samples. Aroclor-1260, a PCB, was found in two surface water samples collected from the Scioto River, one upstream and one downstream. Several metals were also detected in surface water samples. However, many of these metals occur naturally. Aluminum, barium, chromium, and mercury were found above upstream background concentrations in at least one sample each.

Several SVOCs were detected in sediment samples collected from the Scioto River and drainage ditches near the site. These include polynuclear aromatic hydrocarbons (PAH), phthalate compounds, 4-methylphenol, chlordane, and PCBs. PAHs and phthalates were also found at similar concentrations in upstream background samples. PCBs were detected at three locations in drainage ditches adjacent to the landfill (SE-27, SE-28, and SE-29) and appear to have originated from the site. The maximum concentration detected was 2,300 μg/kg. Chlordane, a pesticide, was found at concentrations ranging from 120 to 200 μg/kg in three locations. All three locations (SE-20, SE-21, and SE-22) were in or adjacent to the Scioto River, near the southern end of the landfill. While chlordane may be associated with landfilling, the occurrence of this pesticide could also be due to agricultural activities in the field west of the landfill. The occurrence of 4-methylphenol appears to be concentrated near the southern end of the landfill and the drainage ditch to the east. This SVOC was found in seven sampling locations, with a maximum concentration of 8,600 μg/kg at SE-22.

Several metals were found above background levels in sediment samples. These include aluminum, barium, cadmium, chromium, lead, mercury, vanadium, and zinc. However, these metals were found at elevated levels in only a few (no more than four) sampling locations at various locations on the landfill.

FIGURE 4. – SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS



5.3 Soils

Surface soil samples were collected from 22 locations in September 1986. These samples were analyzed for VOCs, SVOCs, pesticides, PCBs, metals, cyanide, and dioxin. Additional soilsamples were collected in March 1988 as part of the second phase of the RI. Ten locations were sampled, including seven new locations. This second round of soil samples was analyzed only for arsenic and lead. In all, 29 locations were sampled, including 7 off-site locations. Figure 5 shows the soil sampling locations.

Three pesticides (ß-BHC, dieldrin, and chlordane) were found in soil samples. The pesticides were found at two locations in the field west of the landfill (SO-7 and SO-11), one location at the western end of the landfill (SO-35), and one location south of the landfill (SO-44). The maximum concentration detected was 210 µg/kg of chlordane at locations SO-35 and SO-44. The presence of these pesticides in the field west of the landfill could be due to past agricultural activities.

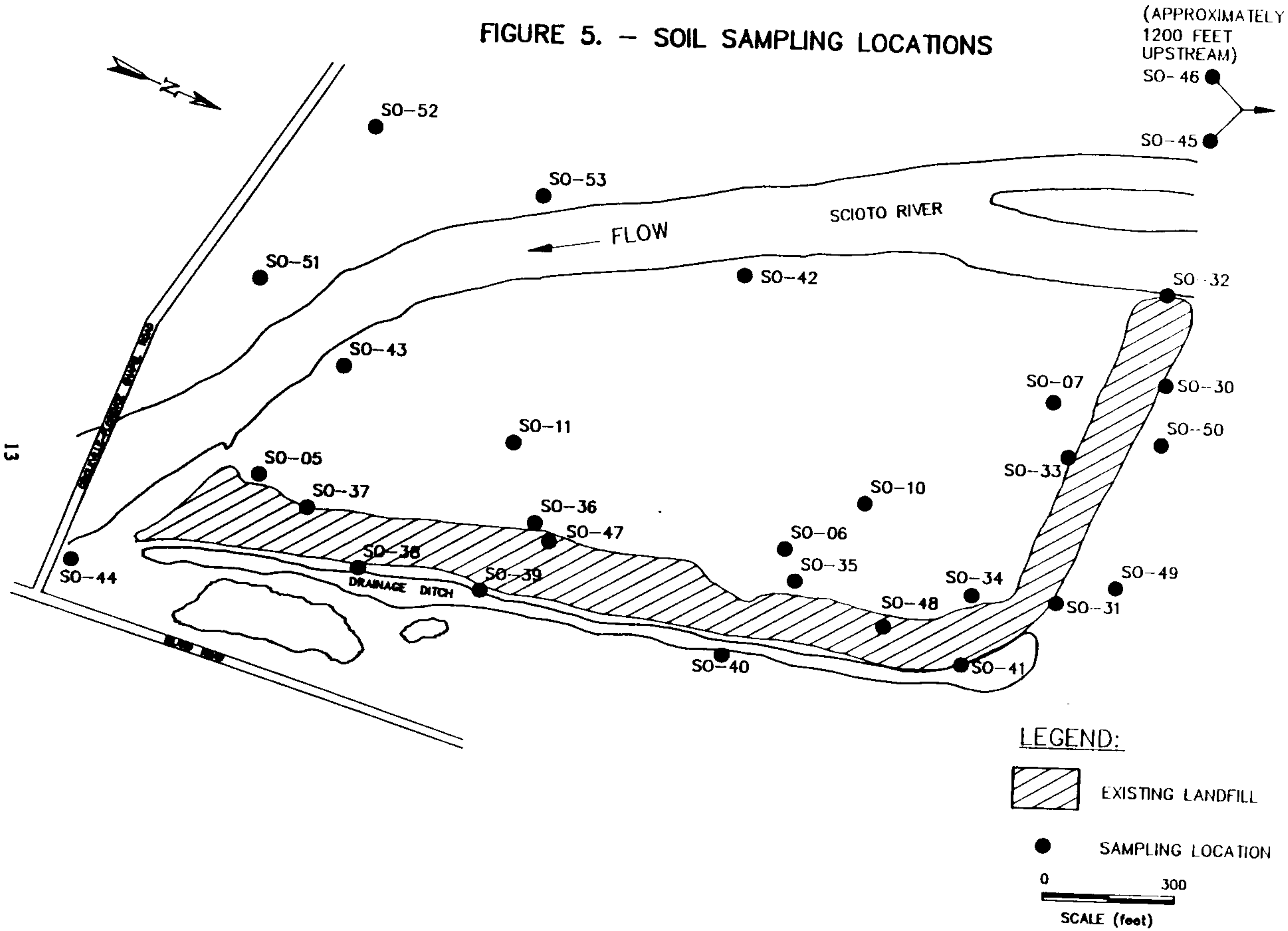
Three PCB compounds (Aroclors 1242, 1248, and 1254) were detected in soil samples at nine locations. Eight of these locations are on or directly adjacent to the landfill, with six of the locations clustered near the northeast corner of the landfill. Thus, the presence of PCBs appears to be related to landfilling activities. The highest concentration, 3,600 µg/kg, was found at location SO-34.

In the first round of soil samples, several metals were found near the landfill at concentrations higher than off-site background levels. These include aluminum, arsenic, cobalt, lead, vanadium, and zinc. A second round of soil samples was collected and analyzed for arsenic and lead to determine whether these metals might be related to landfilling activities. The combined results from the two rounds indicated that soil arsenic levels were similar for samples collected on the landfill, in the agricultural fields directly west and north of the landfill, and from locations west of the Scioto River. However, the results for lead indicated that soil samples collected from the landfill had slightly higher concentrations. The maximum lead concentration, 179 mg/kg, was found at location SO-35.

5.4 Air

No quantitative air samples were collected during the RI at Bowers Landfill. Thus, the extent of air contamination at the site is not known. However, air monitoring was conducted during the RI for VOCs, radiation, and combustible gases. On-site concentrations were not elevated above background levels.

FIGURE 5. – SOIL SAMPLING LOCATIONS



Bowers Landfill has a low potential for VOC emissions to air because very few VOCs were found in surface soils, surface water, or sediments. Other contaminants found in surface soils, such as PCBs, PAHs, and metals, could become airborne if dust is released from the landfill surface. However, the site is currently covered with vegetation and has very little exposed soil.

6.0 SUMMARY OF SITE RISKS

PRC Environmental Management, Inc., under contract to U.S. EPA (No. 68-01-7331), conducted an endangerment assessment (EA) for Bowers Landfill. This section summarizes the findings of the EA and characterizes site risks.

6.1 Indicator Chemicals

The EA used standard U.S. EPA procedures, as outlined in the Superfund Public Health Evaluation Manual, to identify indicator chemicals for Bowers Landfill. The EA focused on potential exposure to and risks from these chemicals. The indicator chemicals were generally those contaminants that exhibited the most toxic properties, were found in several environmental media, or were detected at the greatest frequency.

The indicator chemicals included three metals (barium, lead, and mercury); two VOCs (benzene and tetrachloroethene); two SVOCs (4-methylphenol and PAHs); PCBs; and one pesticide (chlordane). The EA evaluated PAHs as a class of chemicals, focusing on those PAHs that are known or suspected carcinogens. Tables 1 through 4 identify the detection frequencies and concentrations (mean and maximum) of indicator chemicals in samples collected during the RI. Results are organized by environmental medium (ground water, surface water, sediments, and soil).

6.2 Exposure Assessment and Risk Characterization

The indicator chemicals identified in various environmental media during the RI were evaluated to determine the level of risk they pose to public health and the environment. The EA identified 10 potential exposure scenarios for contaminants at or released from Bowers Landfill. Potential risks for each scenario were characterized for human and animal populations that could become exposed.

The EA concluded that potential risks existed under 5 of the 10 scenarios evaluated. These exposure scenarios include ingestion of ground water; ingestion of surface water; ingestion

TABLE 1

DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS IN GROUND WATER NEAR BOWERS LANDFILL

	Upgradient Wells				Downgradient Wells				Residential Wells			
Compound	Frequency of Detection[1]	Adjusted Frequency of Detection[2]	Geometric Mean (µg/L)	Maximum Concentration (µg/L)	Frequency of Detection	Adjusted Frequency of Detection	Geometric Mean (µg/L)	Maximum Concentration (µg/L)	Frequency of Detection	Adjusted Frequency of Detection	Geometric Mean (µg/L)	Maximum Concentration (µg/L)
Barium	16/16	16/16	185	368	37/37	37/37	330	2070	5/5	5/5	112	[130]
Lead	2/16	1/15	1.2	7.0	8/37	1/27	1.2	6.9	0/5	—	—	—
Mercury	2/16	0/16	—	—	0/37	—	—	—	0/5	—	—	—
Benzene	0/16	—	—	—	3/37	3/37	0.70	6.0	0/5	—	—	—
Tetrachloroethene	3/16	3/16	0.89	5.3	0/37	—	—	—	0/5	—	—	—
Chlordane	0/16	—	—	—	0/37	—	—	—	0/5	—	—	—
PCBs	0/16	—	—	—	0/37	—	—	—	0/5	—	—	—
4-Methylphenol	0/16	—	—	—	0/37	—	—	—	0/5	—	—	—
PAHs	0/16	—	—	—	0/37	—	—	—	0/5	—	—	—

Notes:

[ ] Estimated value; compound found at concentration below U.S. EPA required detection limit

— Not calculated

1 Frequency of detection is defined as a/b, where –
 a = number of times a compound was detected
 b = total number of samples
 Sample results which were identified by the laboratory as due to blank contamination are not counted in either a or b.

2 Adjusted frequency of detection omits samples from which results were questionable due to QA/QC problems; only samples included in this column were used to determine geometric mean and maximum concentrations.

TABLE 2

DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS IN SURFACE WATER NEAR BOWERS LANDFILL

	Scioto River - Upstream				Scioto River - Downstream				Drainage Ditches			
Compound	Frequency of Detection[1]	Adjusted Frequency of Detection[2]	Geometric Mean (µg/L)	Maximum Concentration (µg/L)	Frequency of Detection	Adjusted Frequency of Detection	Geometric Mean (µg/L)	Maximum Concentration (µg/L)	Frequency of Detection	Adjusted Frequency of Detection	Geometric Mean (µg/L)	Maximum Concentration (µg/L)
Barium	2/2	2/2	56	[60]	9/9	9/9	54	[60]	19/19	19/19	101	[199]
Lead	1/2	0/1	—	—	4/9	0/5	—	—	4/19	1/15	1.3	8.6
Mercury	0/2	—	—	—	2/9	1/3	0.13	0.20	1/19	1/5	0.12	0.27
Benzene	0/2	—	—	—	0/9	—	—	—	0/19	—	—	—
Tetrachloroethene	1/2	1/2	0.74	1.1 J	2/9	2/9	0.59	1.1 J	0/19	—	—	—
Chlordane	0/2	—	—	—	0/9	—	—	—	0/19	—	—	—
PCBs	1/2	1/2	0.77	1.2	0/9	—	—	—	1/19	1/19	0.55	2.6
4-Methylphenol	0/2	—	—	—	0/9	—	—	—	0/19	—	—	—
PAHs	0/2	—	—	—	0/9	—	—	—	0/19	—	—	—

Notes:

[ ], J Estimated value; compound found at concentration below U.S. EPA required detection limit

— Not calculated

1 Frequency of detection is defined as a/b, where --
a = number of times a compound was detected
b = total number of samples
Sample results which were identified by the laboratory as due to blank contamination are not counted in either a or b.

2 Adjusted frequency of detection omits samples from which results were questionable due to QA/QC problems; only samples included in this column were used to determine geometric mean and maximum concentrations.

TABLE 3

DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS IN SEDIMENTS NEAR BOWERS LANDFILL

Compound	Scioto River – Upstream				Scioto River – Downstream				Drainage Ditches			
	Frequency of Detection[1]	Adjusted Frequency of Detection[2]	Geometric Mean (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Adjusted Frequency of Detection	Geometric Mean (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Adjusted Frequency of Detection	Geometric Mean (mg/kg)	Maximum Concentration (mg/kg)
Barium	2/2	2/2	113	118	9/9	9/9	106	312	19/19	19/19	128	227 E
Lead	2/2	2/2	31	38	9/9	8/8	34	39	19/19	15/15	39	104
Mercury	2/2	1/1	—	0.40	9/9	4/4	0.48	0.59	10/19	6/15	0.14	1.4
Chlordane	0/2	—	—	—	2/9	2/9	0.067	0.200	2/19	2/19	0.055	0.140
PCBs	0/2	—	—	—	0/9	—	—	—	5/19	5/19	0.105	2.300
Benzene	0/2	—	—	—	0/9	—	—	—	0/19	—	—	—
Tetrachloroethene	0/2	—	—	—	0/9	—	—	—	0/19	—	—	—
4-Methylphenol	0/2	—	—	—	2/9	2/9	0.069	8.600	7/19	7/19	0.091	8.100
PAHs												
Benzo(a)anthracene	2/2	2/2	0.415	0.420 J	8/9	8/9	0.256	3.600	11/19	11/19	0.072	0.400 J
Benzo(a)pyrene	2/2	2/2	0.408	0.450 J	9/9	9/9	0.217	0.370 J	11/19	11/19	0.077	0.400 J
Benzo(b)fluoranthene	2/2	2/2	0.900	0.910	9/9	9/9	0.451	0.750	13/19	13/19	0.137	1.000
Chrysene	2/2	2/2	0.519	0.550	9/9	9/9	0.287	0.480	12/19	12/19	0.095	0.710 J
Dibenzo(a,h) anthracene	2/2	2/2	0.116	0.160 J	1/9	1/9	0.030	0.130 J	1/19	1/19	0.027	0.092 J
Indeno(1,2,3-cd) pyrene	2/2	2/2	0.275 J	0.290 J	5/9	5/9	0.064	0.250 J	8/19	8/19	0.049	0.270 J

Notes:

J Estimated value; compound found at concentration below U.S. EPA required detection limit

E Concentration is estimated due to presence of interference during analysis

— Not calculated

1 Frequency of detection is defined as a/b, where –
  a = number of times a compound was detected
  b = total number of samples
  Sample results which were identified by the laboratory as due to blank contamination are not counted in either a or b.

2 Adjusted frequency of detection omits samples from which results were questionable due to QA/QC problems; only samples included in this column were used to determine geometric mean and maximum concentrations.

TABLE 4

DETECTION FREQUENCIES AND CONCENTRATIONS OF INDICATOR CHEMICALS IN SOILS NEAR BOWERS LANDFILL

Compound	Background Locations				Locations On or Adjacent to the Landfill				Agricultural Areas			
	Frequency of Detection[1]	Adjusted Frequency of Detection[2]	Geometric Mean (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Adjusted Frequency of Detection	Geometric Mean (mg/kg)	Maximum Concentration (mg/kg)	Frequency of Detection	Adjusted Frequency of Detection	Geometric Mean (mg/kg)	Maximum Concentration (mg/kg)
Barium	2/2	2/2	152	156	15/15	15/15	189	287	7/7	7/7	121	198
Lead	5/5	5/5	47	74 E	21/21	21/21	78	179	11/11	11/11	59	102 E
Mercury	2/2	0/2	—	—	15/15	15/15	0.27	0.43	7/7	2/2	0.48	0.58
Chlordane	0/2	—	—	—	2/15	2/15	0.015	0.210	1/7	1/7	0.014	0.110
PCBs	0/2	—	—	—	9/15	9/15	0.238	3.600	1/7	1/7	0.063	0.240
Benzene	0/2	—	—	—	0/15	—	—	—	0/7	—	—	—
Tetrachloroethene	0/2	—	—	—	0/15	—	—	—	0/7	—	—	—
4-Methylphenol	0/2	—	—	—	0/15	—	—	—	0/7	—	—	—
PAHs												
Benzo(a)anthracene	2/2	2/2	0.130	0.140 J	14/15	14/15	0.116	4.300	6/7	6/7	0.081	0.210 J
Benzo(a)pyrene	2/2	2/2	0.134	0.150 J	12/15	12/15	0.115	4.300	5/7	5/7	0.088	0.230 J
Benzo(b)fluoranthene	2/2	2/2	0.265	0.280 J	11/14	11/14	0.178	8.600	7/7	7/7	0.204	0.510
Chrysene	2/2	2/2	0.160	0.160 J	14/15	14/15	0.169	5.200	7/7	7/7	0.136	0.240 J
Dibenzo(a,h) anthracene	0/2	—	—	—	1/15	1/15	0.026	0.960 J	0/7	—	—	—
Indeno(1,2,3-cd) pyrene	1/2	1/2	0.047	0.110 J	11/15	11/15	0.073	2.600	4/7	4/7	0.054	0.160 J

Notes:

J Estimated value; compound found at concentration below U.S. EPA required detection limit

E Concentration is estimated due to presence of interference during analysis

— Not calculated

1 Frequency of detection is defined as a/b, where --
  a = number of times a compound was detected
  b = total number of samples
  Sample results which were identified by the laboratory as due to blank contamination are not counted in either a or b.

2 Adjusted frequency of detection omits samples from which results were questionable due to QA/QC problems; only samples included in this column were used to determine geometric mean and maximum concentrations.

of aquatic animals; ingestion of soils; and direct contact with surface water. The first four scenarios apply to humans living near Bowers Landfill while the fifth scenario applies to aquatic species living in the Scioto River near the landfill. The potential risks associated with each scenario are summarized in Table 5 and discussed below.

6.2.1 Ingestion of Ground Water

The EA identified a potential risk from drinking ground water immediately downgradient of the landfill. The area included in this scenario is the field between the landfill and the Scioto River. Ground water in this area contains barium (a noncarcinogen) and benzene (a carcinogen) at concentrations above U.S. EPA Maximum Contaminant Levels (MCL) for drinking water. However, each contaminant exceeded the standard in only one well; samples from all other wells contained barium and benzene concentrations well below MCLs.

The EA assumed that a 70-kg adult would drink 2 liters of ground water per day over a 70-year lifetime. Probable case doses from this exposure were calculated using average barium and benzene concentrations in downgradient ground water (Table 1). Worst case doses were calculated from maximum concentrations. The EA then used these doses to estimate potential risks. Noncarcinogenic risks were estimated by calculating a Hazard Index (HI), the ratio of the exposure dose to the acceptable chronic intake for barium. This ratio was 1.04 for the maximum barium concentration, indicating that the estimated dose exceeded the acceptable dose. Probable case risks were much lower, with the HI equal to 0.17. Carcinogenic risks for benzene were estimated by multiplying the exposure dose by the carcinogenic potency factor (CPF). For worst case exposure conditions, this risk was 9×10^{-6}; the probable case risk was 1×10^{-6}.

Although these risks are significant, exposure is unlikely to occur. Ground water downgradient of the site, between the landfill and the Scioto River, is not currently used as a drinking water source. Further, this area is often flooded and is not a likely location for future drinking water wells.

In addition to these potential future risks, the EA looked at risks to current users of ground water near Bowers Landfill. All existing residential wells near the site are upgradient. Four residential wells were sampled during the RI and showed no effects of the landfill on water quality (Table 1). The City of Circleville water supply is also of concern. Circleville obtains its municipal water supply from a wellfield approximately 1½ miles south of the site. However, the RI study of the area south of the landfill was limited. The EA considered the possibility of regional ground-water flow to the south, along the Scioto River basin. To investigate this possibility, the EA reviewed water quality sampling data submitted by the city to the Ohio

TABLE 5

SUMMARY OF POTENTIALLY SIGNIFICANT RISKS IDENTIFIED FOR BOWERS LANDFILL

Exposure Route	CA/NCA[1]	Contaminants	Risk Assessment	Comments
1. Ingestion of Ground Water	NCA	Barium	Hazard Index[2] = 1.04	While based on the maximum barium concentration, the hazard index only slightly exceeds unity. Therefore, the actual noncarcinogenic risk via this scenario is probably very small.
	CA	Benzene	Incremental Carcinogenic risk = 9×10^{-6} (worst case), 1×10^{-6} (probable case)	The incremental carcinogenic risks for benzene are within the target range of 10^{-4} to 10^{-7} (see footnote No. 3).
2. Ingestion of Surface Water	CA	PCBs	Maximum PCB concentration in the drainage ditches (2.6 ug/L) exceeds the ambient water quality criterion (AWQC) *for consumption of drinking* water. This AWQC (0.013 ug/L) corresponds to a 10^{-6} cancer risk.	The AWQC for PCBs assumes lifetime exposure while this scenario assumes infrequent incidental ingestion; therefore, this comparison overestimates the actual risk.
3. Ingestion of Aquatic Animals	NCA	Mercury	The maximum mercury concentration (0.2 ug/L) exceeds the AWQC based on ingestion of aquatic animals (0.146 ug/L).	Tissue samples have not been taken to verify the extent of this exposure. However, average mercury concentrations were below the AWQC and mercury was found in only one surface water sample from the Scioto River. Thus, this risk is limited.
4. Ingestion of Soils	NCA	Lead	Hazard Index = 3.20	This hazard index may overestimate the actual risk because it assumes both the maximum lead concentration and a worst case soil ingestion rate. Further, lead levels in on-site soils are below Centers for Disease Control (CDC) guidelines for residential areas.
	CA	Total PAHs[4]	Incremental Carcinogenic Risk = 2×10^{-6}	These two risks may overestimate the actual risk because they are based on maximum concentrations and a worst case soil ingestion rate. See also Footnote No. 3.
		PCBs	Incremental Carcinogenic Risk = 7×10^{-7}	
5. *Direct Contact with Surface Water by Aquatic Animals*	NCA	Mercury	Maximum mercury concentration (0.2 ug/L) exceeds the 4-day AWQC for protection of aquatic life (0.012 ug/L).	*Actual risk may be negligible based on average mercury concentrations.* Further mercury was found in only one surface water sample from the Scioto River.

Notes:

1 CA = Carcinogenic
NCA = Noncarcinogenic

2 The hazard index (HI) is calculated as the ratio of exposure dose to acceptable dose; an HI>1 indicates a potentially significant risk.

3 U.S. EPA guidance describes a target carcinogenic risk range of 10^{-4} to 10^{-7}. Risks greater than 10^{-4} are considered "significant", while risks $<10^{-7}$ are considered insignificant. Risks between 10^{-4} and 10^{-7} are within the target range; their significance will, in general, reflect site specific factors.

4 Calculations included the following carcinogenic PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d)pyrene. The incremental carcinogenic risk for total PAHs was calculated by multiplying the maximum concentration of each PAH other than benzo(a)pyrene by a relative potency factor to benzo(a)pyrene. The adjusted concentrations were then summed along with the concentration of benzo(a)pyrene itself and, finally, multiplied by the carcinogenic potency factor for benzo(a)pyrene. Details of this calculation process are described in the Endangerment Assessment Report for Bowers Landfill.

Department of Health over an 8-year period from 1980 to 1987. Based on this review, there is no evidence that Bowers Landfill has affected Circleville's water supply. Table 6 summarizes the data reviewed.

6.2.2 Ingestion of Surface Water

The EA identified a potential risk from ingestion of contaminated surface water. This exposure scenario was based on accidental ingestion of surface water near Bowers Landfill. Access to the landfill is not restricted, and exposure could occur if people waded in or fell into drainage ditches or the Scioto River near the landfill. The EA evaluated potential risks by comparing maximum surface water concentrations with U.S. EPA guidelines for acute or short-term exposure. Of the indicator chemicals found in surface water, only PCBs exceeded a guideline. The maximum PCB concentration of 2.6 μg/L (Table 2) was higher than the long-term ambient water quality criterion (AWQC) of 0.0126 μg/L. However, the AWQC is based on lifetime consumption of 2 liters of PCB-contaminated water per day. Thus, the AWQC is not directly applicable to the infrequent exposure and small amounts of water ingested under this exposure scenario. The EA concluded that risks from ingesting contaminated surface water were limited.

6.2.3 Ingestion of Aquatic Animals

The EA identified a potential risk from ingestion of aquatic animals from near Bowers Landfill. This exposure scenario was based on ingestion of fish and other aquatic species taken from the Scioto River. The EA compared downstream surface water concentrations (Table 2) to AWQCs for ingestion of aquatic species. Only one indicator chemical, mercury, was found above background (upstream) concentrations in the Scioto River near Bower Landfill. The maximum mercury concentration in river water (0.2 μg/L) slightly exceeded the AWQC (0.146 μg/L); the average mercury concentration was below the AWQC. This AWQC was developed by U.S. EPA to protect persons who consume 6.5 grams per day of aquatic organisms taken from mercury-contaminated water. The EA characterized risks from this scenario as limited for two reasons. First, mercury was found in only one sample from the Scioto River. Second, the mercury concentration in this sample only slightly exceeded the AWQC.

6.2.4 Ingestion of Soils

The EA identified a potential risk from ingesting contaminated soils at or near Bowers Landfill. Access to the site is not restricted, so small children could reach the site and ingest contaminated soil. The EA assumed that a 20-kg child would eat contaminated soil 10 days per

TABLE 6

SUMMARY OF WATER QUALITY SAMPLING RESULTS FOR THE CITY OF CIRCLEVILLE DEPARTMENT OF PUBLIC UTILITIES, WATER SUPPLY SYSTEM, 1980-1987
(CONCENTRATIONS OF INDICATOR CHEMICALS IN ug/L)

Location:	114 W. Franklin	#1 Well	#2 Well	#3 Well	Wells 1, 2 and 3	663 Hassle Rd.
Dates:	08/24/87	06/19/86	06/19/86	06/19/86	12/05/85	04/27/83
Compound						
Barium	160	<300	<300	<300	<300	—
Lead	1	ND	<5	<5	<5	—
Mercury	<0.2	<0.5	<0.5	<0.5	<0.5	—
Chlordane	—	—	—	—	—	ND
PCBs	—	—	—	—	—	ND
Tetrachloroethene[b]	—	—	—	—	—	<0.5
PAHs	—	—	—	—	—	ND

Notes:

Compiled from results submitted to Ohio Department of Health, 1980-1987.

a Only the results for samples that were analyzed for at least 1 indicator chemical other than tetrachloroethene are presented; see footnote b.

b 34 additional samples within this time period were analyzed for tetrachloroethene; all the results were negative.

ND Compound was analyzed for but not detected.

— Compound was not measured.

year over a 3-year period, and that 50 percent of the contaminants in the soil would be absorbed by the body. Probable case doses from this exposure were calculated based on ingesting 0.1 g/day of soil containing average contaminant levels. Worst case doses were calculated based on ingesting 1.0 g/day of soil containing maximum contaminant levels. The EA calculated doses only for those indicator chemicals found at or adjacent to the landfill at concentrations higher than background. These chemicals included barium, lead, mercury, chlordane, PCBs, and PAHs (Table 4).

The EA used the resulting doses to estimate potential risks. Noncarcinogenic risks were estimated by calculating a Hazard Index (HI), the ratio of the exposure dose to the acceptable chronic intake. Under worst case conditions, the total HI was 3.48, indicating that the estimated dose for all noncarcinogenic indicator chemicals exceeded the acceptable dose. Most of the HI was attributable to lead (HI = 3.20). However, the highest measured lead concentration at the site (179 mg/kg) was well below Centers for Disease Control (CDC) guidelines for acceptable lead values in residential soils. These guidelines suggest that lead values between 500 and 1,000 mg/kg are unacceptable.

Cancer risks were estimated by multiplying the average lifetime exposure dose by the CPF. For worst case exposure conditions, the total cancer risk for all chemicals was 3×10^{-6}. Most of this risk was attributable to ingestion of PAHs (2×10^{-6}) and PCBs (7×10^{-7}), with only a small portion due to chlordane. The probable case cancer risk was 5×10^{-9}.

6.2.5 Direct Contact with Surface Water by Aquatic Animals

The EA also identified a potential risk to aquatic species living in the Scioto River. The EA evaluated risks from this exposure scenario by comparing river water concentrations to AWQCs for protection of aquatic life. Only one of the indicator chemicals, mercury, exceeded an AWQC. The maximum mercury concentration of 0.2 μg/L (Table 2) was higher than the 4-day (chronic) AWQC for aquatic species of 0.012 μg/L. This comparison most likely overstates potential risks, since mercury was found in only one sample collected from the Scioto River.

6.3 Potential Future Risks

Even though contaminant concentrations measured during the RI are relatively low, the landfill represents a potential threat of future contaminant releases that may endanger public health, welfare, and environment. A major remedial action objective for the site is to reduce this threat of future contaminant releases in addition to reducing current risks identified in the EA. Several factors contribute to the potential threat of future releases.

First, portions of the landfill are poorly covered. The lack of adequate cover is described in inspection reports by the Ohio Department of Health (February 1967) and the Pickaway County Health Department (April 1971). These inspections were conducted shortly before and shortly after waste disposal at Bowers Landfill ended. The lack of adequate cover was confirmed by more recent measurements made in November 1988 as part of the feasibility study. These measurements showed that wastes lie less than 1 foot below the cover in some areas of the landfill.

Second, although operating records for Bowers Landfill are poor, evidence exists that hazardous substances were placed in the landfill. Responses by DuPont and PPG to a 1978 House Subcommittee on Oversight and Investigation estimated that these companies sent approximately 6,000 and 1,700 tons of waste, respectively, to Bowers Landfill from 1965 to 1968. The wastes contained a variety of organic and inorganic chemicals. More recent 1988 responses by DuPont and PPG to information requested under Section 104(e) of CERCLA confirmed the disposal of hazardous substances at landfill. However, these responses contained little additional information on the amounts and types of wastes.

Finally, semiannual flooding of the Scioto River, usually in the spring and winter, also contributes to the threat of contaminant releases. Based on flood stage data for the river and the height of the landfill, portions of the landfill are overtopped by 2-year floods. The entire landfill would be covered by a 50-year flood. Flooding, in combination with trees growing on the landfill side slopes, presents two significant concerns. First, tree roots most likely penetrate directly into waste materials because of the shallow cover depth. These root systems provide a direct pathway for flood waters and precipitation to contact wastes and increase the likelihood of future ground-water contamination. Second, as the trees on the side slopes grow larger over time, they represent a threat to the stability of the side slopes. The combination of flood conditions, saturated soil, and high winds could cause larger trees to topple over, removing portions of the side slopes and exposing the wastes underneath.

7.0 DOCUMENTATION OF SIGNIFICANT CHANGES

This Record of Decision selects Alternative 4, as described in the Proposed Plan, as the preferred remedial alternative for Bowers Landfill. U.S. EPA has reviewed and responded to all comments received during the public comment period. Comments concerned Alternative 4 and other remedial alternatives. U.S. EPA has not made any significant changes to Alternative 4 based on public comments.

Alternative 4 includes the following components: long-term ground-water monitoring; site restrictions and a perimeter fence to limit site access and use; removal of debris and vegetation from the landfill surface; placement of a low-permeability clay cap (consisting of a clay layer, topsoil layer, and vegetation) over the entire landfill surface; drainage improvements to convey rainfall and flood waters away from the landfill; and erosion and flood control measures on areas of the landfill subject to damage from flood waters.

8.0 DESCRIPTION OF ALTERNATIVES

In response to the findings of the EA, the FS identified three potential risks that should be addressed by remedial response actions at Bowers Landfill. These risks are associated with ingestion of ground water immediately downgradient of the landfill, ingestion of soil from the landfill, and future releases from the landfill.

The FS identified technologies that could reduce risks for each of these media. These technologies were assembled into media-specific remedial alternatives. The FS then screened these media-specific alternatives based on effectiveness in reducing risks, implementability, and cost. Media-specific alternatives remaining after the screening process were assembled into nine site-wide remedial alternatives for detailed evaluation. This screening process was carried out according to procedures specified by U.S. EPA in CERCLA, the NCP, and U.S. EPA guidance documents including "Interim Guidance on Superfund Selection of Remedy" (OSWER Directive No. 9355.0-19, December 24, 1986) and "Draft Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (OSWER Directive No. 9355.3-01, March 1988).

The alternatives evaluated in detail include a no action alternative and eight alternatives that rely on containment of waste, with little or no treatment, to reduce site risks. The FS looked at alternatives involving treatment as a principal element to reduce the toxicity, mobility, or volume of site wastes. However, these alternatives were screened out, based on implementability, prior to the detailed analysis. The FS did not develop any remedial alternatives for source control that would eliminate the need for long-term management, including monitoring. Treatment alternatives of this type were not considered feasible because of the large volume and diverse nature of the waste materials in Bowers Landfill.

Each of the nine remedial alternatives evaluated in detail is described briefly below. The descriptions include containment components, institutional controls, estimated time for implementation, cost, overall protection, and compliance with applicable or relevant and appropriate requirements (ARARs). Section 9.0, which describes the comparative analysis of alternatives, includes additional detail on these subjects.

8.1 Alternative 1

Alternative 1 is the no action alternative. CERCLA requires that the no action alternative be considered at every site. Under this alternative, no further action would be taken at Bowers Landfill to reduce risks or to control the sources and migration of contaminants. The no action alternative will not modify the landfill in any way. Thus, it has no associated costs, and no time would be required to implement this alternative.

Capital Cost:	$ 0
Present Worth Operation & Maintenance (O & M) Costs:	$ 0
Total Costs:	$ 0
Time to Implement:	None

8.2 Alternative 2

Alternative 2 includes the following components:

- Ground-water monitoring
- Site restrictions

Under Alternative 2, a long-term monitoring program would be implemented to monitor contaminant concentrations and migration. This program would include the installation of additional monitoring wells south of Bowers Landfill (between the landfill and the Circleville municipal wellfield) and west of the landfill (between the landfill and the Scioto River). These new wells, existing monitoring wells, and possibly residential wells near the landfill would be sampled. The monitoring program would be designed to protect the Scioto River by sampling ground water that discharges to the river. Additionally, the program would sample water from the upper and lower aquifers that may flow under the river and join regional ground-water flow. At a minimum, the program would meet the substantive requirements for ground-water monitoring under the Resource Conservation and Recovery Act (RCRA) as described in 40 CFR 264, Subpart F.

The installation of three additional ground-water monitoring well clusters is necessary to develop a ground-water monitoring program that would adequately detect potential future releases of contaminants. These well clusters would consist of three wells; a shallow well that would be located in the upper portion of the saturated alluvial aquifer, an intermediate well that would be located between the water table and the bedrock, and a deep well that would be located just above the bedrock. Two of these well clusters would be installed west of the landfill. One cluster would be installed between well location 5 and well location 6 and the other between well W-10 and the bend of the landfill (see Figure 3). The third well cluster would be installed off-site between the landfill and the Circleville municipal wellfield. The installation of well clusters in addition to these may also be considered.

The monitoring wells would be sampled on a bimonthly basis for the first year and quarterly for years 2 through 4. During the first year, samples would be analyzed for the full Target Compound List (TCL). A reduced TCL may be considered after the first year. If the levels of contaminants in ground water did not increase over this time period, the sampling schedule would be reevaluated and a reduction in the frequency of sampling may be considered. A statistical test would be developed to determine when a significant increase in the level of contaminants had occurred.

Should a significant increase in the levels of contaminants occur, it would automatically trigger a RCRA corrective action. If the levels of contaminants in ground water exceeded MCLs, where available, or health-based levels, where MCLs are not available, resampling would occur within 14 days. (Health-based levels are concentrations corresponding to a cancer risk of 10^{-6} for carcinogenic contaminants and a hazard index (HI) greater than 1 for noncarcinogenic contaminants.) If the resampling verified that there had been a significant increase in the levels of contaminants, a corrective action program would be implemented. Corrective action may include such measures as the establishment of alternate concentration limits (ACLs), the collection and treatment of ground water, or the removal of the source of contamination.

The surface water in the drainage ditch to the east of the landfill would be sampled on a quarterly basis as part of the monitoring program. Monitoring would verify that discharges from the ditch are in compliance with Ohio Water Quality Standards, as described in the Ohio Administrative Code (OAC) 3745-01. A corrective action program would be implemented if contaminant levels in the ditch exceeded these standards.

Efforts will be made to procure deed restrictions prohibiting ground-water extraction in the field west of the landfill and restricting disturbance of the landfill surface. The viability of continued farming immediately west of the landfill would be evaluated, and, if shown to be necessary, efforts would be made to prohibit such farming by imposition of deed restrictions. A 6-foot fence would be placed around the landfill, the drainage ditch to the east, and the field to the west to limit site access.

Alternative 2 relies entirely on institutional controls and monitoring to reduce risk and does not include any containment or treatment components. Restricting ground-water use immediately downgradient of the site should be effective in eliminating risks from drinking this ground water. However, while fencing is identified as a means for limiting exposure, contaminated soils would remain uncovered. Exposure could still occur through dispersal of soil by erosion and by direct contact if persons enter the site despite the fence. Potential future risks, as described in Section 6.3, would not be reduced. Further, Alternative 2 does not meet State of Ohio closure requirements for solid waste landfills, which has been identified as an ARAR.

The costs of Alternative 2 and the estimated time for implementation are as follows:

Capital Cost:	$ 173,700
Present Worth O & M Costs:	$ 295,100
Total Costs:	$ 468,800
Time to Implement:	1 Month

8.3 Alternative 3

Alternative 3 includes the following components:

- Ground-water monitoring
- Site restrictions
- Management of surface debris
- Local repairs to existing landfill cover
- Erosion control and drainage improvements

Alternative 3 incorporates ground-water monitoring and site restrictions already described under Alternative 2. The additional components of this remedial alternative are discussed below.

The landfill area and its immediate vicinity would be cleared of surface debris. Nonhazardous debris would be disposed of at a nearby sanitary landfill, and any waste items determined to be hazardous would be disposed of at a suitable hazardous waste landfill.

After surface debris has been removed, areas showing signs of erosion would be identified. These areas would be cleared of vegetation and repaired with natural clay soil to be uniform with the surrounding surface. Drainage patterns on the landfill would be surveyed, and areas showing erosion would be repaired with fill. Areas prone to ponding would be regraded to provide a uniformly sloping surface that would drain water off the landfill. The existing vegetation cover of trees on the landfill would be maintained. As part of the maintenance program, the cover would be inspected on a regular basis for structural integrity and vegetative growth.

The drainage ditch east of the landfill would be improved to allow water to drain from the field north of the landfill through this ditch. The pipe that runs under the southern end of the landfill from this ditch would be replaced by a 36-inch-diameter corrugated metal pipe.

Erosion protection would be provided on those landfill areas prone to erosion due to swift-flowing water from the river. This protection would include armor stone (riprap) in areas that abut the river. Stone would also be placed on the north-facing slope of the western edge of the landfill and at the southern edge of the landfill to dissipate the energy of river flow.

Alternative 3 addresses some containment aspects for contaminated soils by providing limited repairs to the existing landfill cover. However, since repairs would be made on a visual basis, this alternative cannot ensure that all areas of contaminated soil would be covered. The landfill would remain largely unchanged and susceptible to erosion and infiltration of precipitation and surface water during flood events. Trees would not be removed from the landfill surface, further increasing the potential for infiltration. As noted for Alternative 2, this alternative does not address Ohio closure requirements for solid waste landfills.

The costs of Alternative 3 and the estimated time to implement this alternative are:

Capital Cost:	$ 1,427,300
Present Worth O & M Costs:	$ 741,000
Total Costs:	$ 2,168,300
Time to Implement:	3 Months

8.4 Alternative 4

Alternative 4 includes the following components:

- Ground-water monitoring
- Site restrictions
- Management of surface debris
- Natural clay cover over landfill
- Erosion control and drainage improvements

Alternative 4 contains the same site restrictions as described for Alternative 2. In addition, the ground-water monitoring program would be identical to the program described under Alternative 2. Erosion and drainage control improvements would be similar to those described for Alternative 3. However, instead of limited repairs to the landfill cover, Alternative 4 includes a clay cover over the entire landfill surface. All trees and other vegetation would be cut down to the surface, and steps would be taken to prevent their growth through the new cover. Precautions would be taken to minimize exposure of buried waste during removal of vegetation.

The new cover would consist of a well-compacted, low-permeability clay cover at least 24 inches thick. A top soil layer at least 24 inches thick would be placed over the clay cover. This top soil layer would be planted with grasses or other shallow-rooted plant species. The cover would exceed Ohio closure requirements for solid waste landfills, which call for only a well-compacted 24-inch cover of suitable material. The clay layer would have a maximum permeability of 10^{-7} cm/sec and would limit infiltration to less than 10 percent of precipitation.

Prior to cover installation, a detailed geotechnical investigation would be conducted to measure the properties of the soil and clay used to construct the cover. The purpose of this investigation would be to determine the stability of these materials under flood conditions. The cover would then be constructed with side slopes flat enough to protect the landfill from damage due to flooding. Construction would be done in such a manner as to minimize potential harm to the floodplain, as required by 40 CFR 6, Appendix A, Statement of Procedures on Floodplain Management and Wetlands Protection. In addition, the cap would be constructed, operated, and maintained to prevent washout of any hazardous wastes by a 100-year flood, as required by RCRA General Facility Standards in 40 CFR 264.18. These regulations have been identified as a location-specific ARARs.

The cap and fence would be inspected on a quarterly basis and repairs of any significant damage would begin within 30 days. The landfill would also be inspected for leachate and methane gas production on a quarterly basis. If leachate production occurred that could potentially adversely affect public health or the environment, a leachate collection system would be installed and the leachate would be collected and treated. If methane gas production occurred that could potentially adversely affect public health or the environment, a gas venting system would be installed.

The drainage ditch adjacent to the east side of the landfill would be improved by removing sediments as necessary. The pipe that runs under the landfill from the southern end of the ditch would be replaced by a 36-inch-diameter corrugated metal pipe. These improvements would allow water to drain from the field north of the landfill through the ditch and into the Scioto River. During the design of this alternative, the feasibility of removing contaminated sediments from the drainage ditch would be evaluated. These sediments could be dewatered as necessary and placed on the landfill surface prior to installing the clay cap. The drainage ditch, which is contiguous with the eastern side slope of the landfill, can be considered part of the landfill. Therefore, movement of sediments from the ditch to the landfill would consolidate hazardous wastes within a single disposal unit. This would not constitute "land disposal" under RCRA Subtitle C, so RCRA land disposal restrictions in 40 CFR 268 would not be ARARs. Sediment removal, in conjunction with capping, would reduce the possibility of contaminated surface water discharges from the ditch to the Scioto River.

Alternative 4 uses site restrictions to reduce risks from ingestion of ground water. Soil ingestion risks would be greatly reduced because the entire landfill surface, where highest soil contamination levels were found, would be covered. Long-term risks would be reduced by the application of a cover that reduces infiltration through the landfill.

The costs and time to implement Alternative 4 are listed below:

Capital Cost:	$ 3,173,000
Present Worth O & M Costs:	$ 1,094,500
Total Costs:	$ 4,267,500
Time to Implement:	10 Months

8.5 Alternative 5

Alternative 5 includes the following components:

- Ground-water monitoring
- Site restrictions
- Management of surface debris
- Natural clay cover over landfill
- Erosion control and drainage improvements
- Leachate collection system
- Gas venting system

Alternative 5 is identical to Alternative 4, except that the landfill cover would incorporate gas venting and leachate collection systems. The gas venting system would consist of a network of perforated pipe, approximately 6 inches in diameter, laid at 100-foot intervals in a 12-inch layer of gravel over the landfill surface. The gravel layer would have a geotextile fabric placed over the top to prevent spaces in the gravel layer from clogging. A 24-inch clay cover would be placed over the gravel layer, followed by a 24-inch soil and vegetation cover. Gas vents would connect to the perforated pipe and exit vertically through the clay and soil covers. Gases containing high concentrations of VOCs could be passed through a vapor phase carbon adsorption system to remove these contaminants.

The leachate collection system, located at the toe of the landfill, would consist of a perforated PVC pipe in a trench filled with granular drainage material. The pipe would catch and direct leachate to a collection point. From there, the leachate would be pumped to a temporary holding tank, treated, and discharged.

Alternative 5 would provide slightly greater protection than Alternative 4 because of the added leachate and gas collection systems. It would also comply with ARARs and would exceed Ohio solid waste landfill closure requirements.

The costs and time to implement Alternative 5 are as follows:

Capital Costs:	$ 4,341,200
Present Worth O & M Costs:	$ 2,374,600
Total Costs:	$ 6,715,800
Time to Implement:	10 Months

8.6 Alternative 6

Alternative 6 includes the following components:

- Ground-water monitoring
- Site restrictions
- Management of surface debris
- Natural clay cover over landfill
- Drainage improvements
- Leachate collection system
- Gas venting system
- Flood protection dike

Alternative 6 is identical to Alternative 5, except that additional flood protection would be provided by constructing a flood protection dike. The dike would extend around the west and north sides of the landfill. A concrete wall would be constructed at the south and northwest corners of the landfill, where there is insufficient space for a dike between the landfill and the river. The core of the flood dike would be constructed of an impervious clay material, and the side slopes would be constructed from clean soil. The sides of the dike along the river would be protected against surface water erosion by concrete riprap or rock fill. Stormwater within the flood control dike and the ditch east of the landfill would be collected through a gravity drainage system that discharges water to the river through check valves.

Alternative 6 addresses all site risks, including the potential risk of future releases from the landfill. The flood protection dike would provide additional protection to the landfill, once the new clay cover is installed. Alternative 6 would exceed Ohio solid waste closure requirements and would comply with ARARs for construction in floodplains.

The costs and implementation time for Alternative 6 are as follows:

Capital Costs:	$ 9,094,300
Present Worth O & M Costs:	$ 3,060,000
Total Costs:	$ 12,154,300
Time to Implement:	18 Months

8.7 Alternative 7

Alternative 7 includes the following components:

- Ground-water monitoring
- Site restrictions
- Management of surface debris
- Synthetic membrane cap over landfill
- Drainage improvements
- Leachate collection system
- Gas venting system
- Flood protection dike

Alternative 7 is similar to Alternative 6 except that a synthetic membrane cap would be placed over the landfill rather than a clay cap. The design of the landfill cap would be similar to the design specified in the Resource Conservation and Recovery Act (RCRA). A permeable geotextile fabric would be placed over the gas collection and venting system, followed by a 2-foot-thick layer of compacted clay with a permeability of 10^{-7} cm/sec. A 20-mil (minimum) synthetic membrane would be placed directly on the compacted clay layer. Finally, a 12-inch drainage layer with a hydraulic conductivity of at least 10^{-3} cm/sec would be placed over the synthetic liner, followed by a 24-inch-thick vegetated soil cover. The FS estimates that this cap would reduce infiltration through the landfill to less than 1 percent of precipitation. In addition, the flood protection dike would minimize the chance of flood waters contacting the landfill surface.

Alternative 7 addresses all site risks, including the potential risk of future releases from the landfill. This alternative would exceed Ohio solid waste closure requirements and would comply with ARARs for construction in floodplains.

The estimated costs and implementation time for Alternative 7 are:

Capital Costs:	$ 10,367,400
Present Worth O & M Costs:	$ 3,449,300
Total Costs:	$ 13,816,700
Time to Implement:	18 Months

8.8 Alternative 8

Alternative 8 includes the following components:

- Ground-water monitoring
- Site restrictions
- Management of surface debris
- Synthetic membrane cap over landfill
- Erosion control and drainage improvements
- Leachate collection system
- Gas venting system

Alternative 8 is similar to Alternative 7, without the flood protection dike. Instead of the dike, this alternative provides erosion control at the ends of the landfill using riprap as described under Alternative 3. All other components of this alternative have been described previously and are not repeated here.

The synthetic membrane cap over the landfill would cover most contaminated soils and would reduce long-term risks by reducing infiltration through the landfill cover to less than 1 percent of precipitation. This alternative would exceed Ohio solid waste closure requirements and would comply with ARARs for construction in floodplains.

The estimated costs and implementation time for Alternative 8 are:

Capital Costs:	$ 6,228,500
Present Worth O & M Costs:	$ 2,328,400
Total Costs:	$ 8,556,900
Time to Implement:	10 Months

8.9 Alternative 9

Alternative 9 includes the following components:

- Ground-water monitoring
- Site restrictions
- Management of surface debris
- Natural clay cover over top of landfill
- Improvements to landfill side slopes
- Erosion control and drainage improvements

Alternative 9 is similar to Alternative 3, except that a natural clay cover would be placed on the top of the landfill. This clay cover would be similar to the cover installed over the entire landfill surface in Alternative 4. Under Alternative 9, side slopes would not be covered, but would be repaired as necessary. These repairs would be made to increase the depth of the cover and provide continuously sloping surfaces. The tree cover on the landfill side slopes would be thinned out, but most trees would be left in place.

Drainage patterns would be surveyed, and areas such as erosion rifts and terraces would be filled and regraded to match adjacent contours. The fill applied to the side slopes would be compacted. Where side slopes are steep, additional stabilization would be accomplished by placing riprap or by supporting the slopes using sheet piling or soil cement.

Drainage control berms would be constructed at the top of the landfill to collect stormwater runoff. The water collected by the berms would be directed to the base of the side slopes by drainage chutes. The collection and drainage system would help reduce infiltration through the side slopes by limiting the area contacted by runoff from the top of the landfill.

Alternative 9 addresses some containment aspects for contaminated soils by covering the top of the landfill and providing limited repairs to the side slopes. However, this alternative cannot ensure that all areas of contaminated soil would be covered. The landfill side slopes would remain largely unchanged and susceptible to erosion and infiltration of precipitation and surface water during flood events. Trees would not be removed from the landfill surface, further increasing the potential for infiltration. This alternative would not meet Ohio closure requirements for solid waste landfills because of the incomplete repairs to side slopes.

The costs of Alternative 9 and the estimated time to implement this alternative are:

Capital Costs:	$ 2,483,500
Present Worth O & M Costs:	$ 955,900
Total Costs:	$ 3,439,400
Time to Implement:	8 Months

9.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

U.S. EPA used the following nine criteria to evaluate each of the alternatives identified in the FS report. The remedial alternative selected for the site must represent the best balance among the evaluation criteria.

1. **Overall Protection of Human Health and the Environment** addresses whether a remedy adequately protects human health and the environment and whether risks are properly eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with Applicable or Relevant and Appropriate Requirements** addresses whether a remedy meets all state and federal laws and requirements that apply to site conditions and cleanup options.

3. **Long-Term Effectiveness and Permanence** refers to the ability of a remedy to reliably protect human health and the environment over time once cleanup goals have been met.

4. **Reduction of Toxicity, Mobility, or Volume** are three principal measures of the overall performance of an alternative. The 1986 Superfund Amendments and Reauthorization Act (SARA) emphasizes that, whenever possible, U.S. EPA should select a remedy that will permanently reduce the level of toxicity of the contaminants at the site, the spread of contaminants away from the site, and the volume, or amount, of contaminants at the site.

5. **Short-Term Effectiveness** refers to the likelihood of any adverse impacts to human health or the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. **Implementability** is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the remedy.

7. Cost includes capital and operation and maintenance costs of implementing a remedy.

8. **State Acceptance** indicates whether, based on its review of the RI, EA, FS, and Proposed Plan, the State of Ohio (OEPA) concurs with, opposes, or has no comment on the alternative U.S. EPA is proposing as the remedy for the site.

9. **Community Acceptance** indicates whether the public concurs with the remedy presented in U.S. EPA's proposed plan.

After evaluating all the remedial alternatives developed in the FS, using the nine criteria just described, U.S. EPA has selected Alternative 4 to address contamination at the Bowers Landfill Superfund site. The rationale for this selection is provided below.

9.1 Overall Protection of Human Health and the Environment

Alternative 4 would protect both human health and the environment. This alternative would reduce potential risks from ingestion of contaminated soil by installing a fence around the site and by covering the most highly contaminated soils with 4 feet of clay and soil. The FS estimates that probable case risks for soil ingestion would be reduced to zero. Some residual risk would remain due contaminated soils in the field west of the landfill. To estimate exposure to this remaining contamination, the FS assumed that (1) 50-kg teenagers would scale the fence surrounding the site 10 times per year over a 5-year period, (2) these teenagers would ingest 200 mg of contaminated soil per visit, and (3) 50 percent of the contaminants in ingested soil would be absorbed by the body. Based on these assumptions and the maximum soil contaminant concentrations in the areas not affected by the cover, the HI for noncarcinogenic risks would be reduced from 3.48 to 0.24. The carcinogenic risk, based on average lifetime exposure, would be reduced from 3×10^{-6} to 4×10^{-8}. Risk reductions for Alternatives 5 through 8, which cover the same areas of soil contamination, would be identical. In contrast, Alternatives 2, 3, and 9 do not cover the entire landfill surface and would provide a smaller risk reduction. The FS estimates that these alternatives would result in an HI of 0.28 for noncarcinogenic effects and a carcinogenic risk of 5×10^{-7}.

Alternative 4 would reduce risks from ingestion of ground water by placing access restrictions on the area west of the landfill. These restrictions would prevent the use of this area as a future ground-water source. In addition, the clay and soil cap would reduce infiltration to less than 10 percent of precipitation, reducing the likelihood of future ground-water contamination. Alternatives 5 and 6, which have a similar cap, would also reduce infiltration to less than 10 percent. Alternatives 7 and 8, which include a synthetic membrane cap, would provide much greater reductions in infiltration.

Ground-water users farther from Bowers Landfill would be protected by the monitoring program included as part of Alternative 4. This program would include installing and sampling additional wells south and west of the landfill. Expansion of the monitoring network to the south would detect any future migration of ground-water contamination toward the City of Circleville's wellfield, 1½ miles south of the landfill. Alternative 4 would include a corrective action program that would allow prompt response to any significant increases in ground-water contamination that might occur in the future.

Overall, Alternative 4 would be more protective of human health and the environment than Alternatives 1, 2, 3, and 9. These alternatives include either no modifications or limited modifications to the existing landfill surface.

Alternative 4 would be somewhat less protective than Alternatives 5, 6, 7, and 8, which include more extensive remediation. For example, Alternative 7, the most protective alternative, also includes a synthetic membrane cap, a flood protection dike, a leachate collection system, and a gas venting system. The overall effect of these additional measures would not increase protection with respect to ingesting contaminated soils or ground water. The flood protection dike included in Alternatives 6 and 7 may prolong the effective life of the landfill cap due to less erosion from surface water. However, the cap installed under Alternative 4 would be designed and constructed to resist flood damage or washout of wastes by a 100-year flood and would have a minimum 30-year lifetime. The multilayer cap included in Alternatives 7 and 8 might provide greater reductions in infiltration, thus providing greater protection against the generation of contaminated leachate and future ground-water contamination. However, there is little evidence of a leachate problem at Bowers Landfill, and current levels of ground-water contamination are low. Therefore, the low-permeability clay cap constructed under Alternative 4 would provide adequate protection of ground water.

9.2 Compliance with Applicable or Relevant and Appropriate Requirements

Alternative 4 would comply with applicable or relevant and appropriate state and federal requirements (ARARs). These requirements include action-specific ARARs related to closure of Bowers Landfill, location-specific requirements related to the location of the landfill within the 100-year floodplain of the Scioto River, and chemical-specific ARARs for contaminants identified in environmental media at the landfill.

Alternative 4 is primarily a closure plan for Bowers Landfill, and the major action-specific ARARs to be considered are those related to landfill closure. Waste disposal at Bowers Landfill ended around 1968, before the effective date of RCRA. Thus, RCRA Subtitle C requirements for the treatment, storage, and disposal of hazardous wastes are not applicable to remedial actions at the landfill. Additionally, the wastes in Bowers Landfill contain large volumes of low-toxicity material, widely dispersed over a large area that bears little resemblance to the discrete units regulated under RCRA Subtitle C. Nevertheless, portions of RCRA Subtitle C requirements can be considered relevant and appropriate.

The preamble to proposed revisions to the National Contingency Plan (53 Federal Register, December 21, 1988) describes several options for closure of Superfund sites, based on RCRA requirements. One option is "closure with wastes in place." This option requires a final cover over the contaminated materials and post-closure care, including maintenance of the cover, ground-water monitoring, and corrective action if ground-water protection standards are exceeded in the future. A second option is "alternate land disposal closure." Under this option, landfill cover requirements are relaxed because (1) the cover will reduce risks due to direct contact with wastes and (2) the wastes appear to pose a limited threat to ground water.

Alternative 4 falls between these two options, but closer to the first option. The clay cap installed as part of this alternative would have a permeability of 10^{-7} or less. This cap would meet the requirements for the clay layer at the bottom of a hazardous waste landfill, as described in 40 CFR 264.301. Because current ground-water contamination levels at Bowers Landfill suggest a limited threat to ground water, a synthetic membrane layer is not considered a necessary component of the cap. On the other hand, Alternative 4 would exceed the relaxed cover requirements for "alternate land disposal closure." These requirements are more similar to State of Ohio closure regulations for solid waste landfills, which call for a "well compacted layer of final cover material . . . to a depth of at least two feet." Alternative 4 would substantially exceed this requirement by providing a 4-foot-thick cover, including a 2-foot layer of low-permeability clay.

Alternative 4 would also comply with location-specific ARARs. Because Bowers Landfill is located within the 100-year floodplain of the Scioto River, construction within the floodplain is unavoidable. However, Alternative 4 would be constructed in a manner that would minimize potential harm to the floodplain, as specified by floodplain management requirements in 40 CFR 6. In addition, the cap would be constructed, operated, and maintained to prevent washout of any hazardous wastes by a 100-year flood, as required by RCRA General Facility Standards in 40 CFR 264.18.

Alternative 4 would attain chemical-specific ARARs for ground water by reducing infiltration of precipitation and floodwaters through the landfill waste. Ground-water results from the RI showed that benzene slightly exceeded the MCL of 5 μg/L in one sample from well P-6B. Levels in other samples from this well were below the MCL, and benzene was not detected in any of the remaining 12 downgradient wells. Barium also exceeded the MCL in three samples collected from a single well, well P-5B. However, the average barium concentration was well below the MCL. The ground-water monitoring program implemented under Alternative 4 would require regular and systematic sampling and would meet the substantive requirements for ground-water monitoring under RCRA in 40 CFR 264, Subpart F. The monitoring program would include provisions for corrective action should contaminant levels significantly increase in the future.

Additionally, the monitoring program proposed for Alternative 4 would include collecting surface water samples from the ditch east of Bowers Landfill. Surface water monitoring would verify that discharges from the ditch are complying with Ohio Water Quality Standards as described in OAC 3745-01.

Alternatives 5 and 6 would comply with ARARs to the same extent as Alternative 4. Alternatives 7 and 8, by including a synthetic membrane layer in addition to the low-permeability clay layer, would come closer to meeting RCRA requirements for closure with hazardous wastes in place.

Alternatives 1, 2, 3, and 9 would leave some or all of the current soil and vegetation cover intact. These alternatives would not comply with relevant and appropriate portions of RCRA closure regulations or with Ohio closure standards for solid waste landfills. Further, these alternatives would not meet location-specific ARARs because they would not be constructed, operated, and maintained to prevent washout of hazardous wastes by a 100-year flood. Also, Alternatives 1, 2, 3, and 9 would not significantly reduce infiltration of precipitation and flood waters through the landfill, and may not result in attainment of MCLs in ground water.

9.3 Long-Term Effectiveness and Permanence

Because of the large amount of material within Bowers Landfill, the small known percentage of hazardous waste, and the limited risks identified in the EA report, it was not feasible to develop a permanent remedy for Bowers Landfill. However, the low-permeability clay cap specified by Alternative 4 would be designed for a minimum 30-year lifetime. The long-term effectiveness of Alternative 4 would be ensured by ground-water monitoring and maintenance of the clay cap. Monitoring wells downgradient of the landfill would be sampled on a regular basis to determine if contaminant concentrations in ground water are increasing significantly over time. The monitoring program would also include a corrective action component, requiring further remedial action if a significant increase in ground-water contamination is detected. The maintenance program for Alternative 4 would include regularly mowing the vegetation on the cap; inspecting the surface for cracks, settlement, ponding, and erosion; completing appropriate repairs to the cap; and repairing the fence as necessary. In addition to regularly scheduled inspections, additional inspections would be made after floods.

Similar monitoring, inspection, and maintenance would be needed to maintain the long-term effectiveness of Alternatives 5, 6, 7, and 8. These alternatives include additional components, such as a synthetic membrane cap or a flood protection dike, that may increase long-term effectiveness. However, the additional components would not greatly increase long-term effectiveness compared to Alternative 4. Current landfill conditions, 20 years after disposal ceased, indicate that Alternative 4 would be sufficiently protective in the long-term. Thus, the slightly higher long-term effectiveness of Alternatives 5, 6, 7, and 8 does not justify the substantially higher costs of these alternatives.

In contrast, Alternatives 1, 2, 3, and 9 would be much less effective in the long term. Alternatives 1 and 2 do not include any repairs to the existing landfill cover. Alternatives 3 and 9 make limited repairs, but would not cover the entire landfill surface. Alternatives 1, 2, 3, and 9 would also leave trees on the landfill side slopes. These alternatives would allow greater infiltration of precipitation and flood waters than Alternatives 4 through 8 because of the incomplete cover and because tree roots probably penetrate into waste materials below the cover. These alternatives would also have a greater potential for long-term failure of the landfill side slopes. Over time, the combination of saturated soil conditions during flooding and high winds could result in complete uprooting of trees, exposing underlying waste materials.

9.4 Reduction of Toxicity, Mobility, or Volume

None of the remedial alternatives evaluated in the FS report involves treating source materials from Bowers Landfill. Thus, none of the alternatives would reduce the toxicity or volume of hazardous constituents within the waste. Treatment alternatives for the source materials were considered but were not evaluated in detail for several reasons. First, most of the estimated 130,000 cubic yards of waste material in Bowers Landfill consists of general refuse and municipal solid waste. Although the exact amount of hazardous waste placed in the landfill is not known, it is probably a small percentage of the total waste volume. The large volume and variable composition of wastes makes treatment impractical. Second, no operating records exist for the landfill. Thus, it is not feasible to identify locations where hazardous wastes might have been placed. Third, the relatively low levels of contamination found during the RI would not be effectively reduced by treatment.

Alternatives 5, 6, 7, and 8 include provisions for installing a leachate collection and treatment system, which is a treatment alternative. This system may reduce the volume and mobility of leachate if leachate contains hazardous constituents. However, ground-water analyses from the RI did not indicate significantly elevated contaminant levels in the upper aquifer, which would be the first target of a leachate plume. Additionally, the low-permeability clay cap installed under Alternative 4 should greatly reduce future leachate generation by reducing infiltration through the landfill. For these reasons, the installation of a leachate collection system was considered but then rejected.

Similarly, Alternatives 5, 6, 7, and 8 include a collection system for gases generated by the landfill. Collected gases could be treated, if necessary. However, Alternative 4 does not include gas collection and treatment for the following reasons. First, air monitoring results from the RI showed that air concentrations of volatile organic compounds (VOCs) at Bowers Landfill are similar to off-site background concentrations. Second, the landfill has a low potential to emit VOCs to air because of the low concentrations of VOCs in soils, sediments, and surface water on or adjacent to the landfill. Finally, because of the age of the landfill, most of the potential gas generation may already have taken place. These gases would have readily escaped through the highly permeable soil that now covers the landfill.

Alternative 4 would reduce the mobility of waste materials within the landfill. The FS report estimates that the low-permeability clay cap included in this alternative will reduce direct infiltration into the landfill surface by over 90 percent. This is much more effective than the current soil and vegetation cover. Reducing the amount of water that contacts waste materials within the landfill should reduce the mobility of these materials. Alternatives 5 and 6, which also include a clay cap, would provide similar reductions in infiltration. Alternatives 7 and 8, which include a synthetic plastic liner and a clay cap, would further reduce infiltration (estimated in the FS report as greater than 99 percent). However, these much greater reductions do not appear warranted by current levels of ground-water contamination at Bowers Landfill.

In contrast, Alternatives 1 and 2 (no repairs to the existing cover), Alternative 3 (limited repairs to the cover), and Alternative 9 (application of a partial clay cover) would provide either no reduction or less reduction in infiltration. Each of these alternatives would leave trees on the landfill side slopes. Root systems of these trees would provide a direct path between flood waters or precipitation and the underlying waste materials.

9.5 Short-Term Effectiveness

The FS report estimates that Alternative 4 could be constructed within 10 months; the alternative would effectively protect human health and the environment immediately upon completion. This construction period is longer than the 1 month required for Alternative 3, which includes only limited repairs to the existing landfill cover. Alternatives 5, 8, and 9 would require construction periods similar to that for Alternative 4. However, Alternatives 6 and 7 would require approximately 18 months to complete due to the more extensive construction activities.

Alternative 4 and the other alternatives could be constructed without significant adverse impacts on the environment and people living near Bowers Landfill. However, all the alternatives, with the exception of those requiring no construction, would present general safety-related risks to construction workers. In addition, earth moving activities could generate dust from the landfill surface that could potentially affect workers and surrounding populations. However, these effects could be minimized by using standard dust suppression methods, such as watering. Additionally, air monitoring would be conducted to measure contaminants released during construction. Construction practices would be modified as necessary to prevent unacceptable releases.

A major impact of Alternative 4 on the surrounding community would be increased truck traffic near the site. The FS report estimates that approximately 8,000 truckloads of material would enter and leave the site during construction. Over a 10-month period, this figure corresponds to an average of 40 trucks per work day. This could inconvenience local residents, adversely affect local roads, and present a slightly greater risk of traffic accidents near the site. Increased truck traffic is also a component of other construction alternatives. The estimated total number of trucks varies from 1,225 for Alternative 3 to 12,000 for Alternatives 6 and 7.

9.6 Implementability

Alternative 4, and all other alternatives evaluated in the FS report, could be implemented using standard earth moving equipment and construction techniques. However, the primary problem of flooding could affect the implementation of all alternatives except Alternative 1 (no action). Construction activities would have to be scheduled around flood events, since the area adjacent to the landfill is inundated approximately 30 days per year. Construction of Alternatives 4 through 9 is estimated to require 8 to 18 months to complete. Thus, remedial action would have to be segmented into work areas. Work on one area of the landfill would be completed before construction of the next area began. This method would minimize the area of the landfill exposed to any particular flood event.

A second implementation problem, common to Alternatives 3 through 9, is the availability of low-permeability clay near the landfill. These alternatives would require substantial amounts (up to 50,000 cubic yards) of clay for construction. The FS report assumes that a suitable clay source can be found locally. However, if a local source cannot be found, increased transport of clay would be required, resulting in increased costs.

A third implementation problem affects Alternatives 3 through 9. These alternatives would require removing existing vegetation from all or part of the landfill. This activity, especially the removal of large trees, could expose underlying waste materials. Precautions would be taken to minimize this possibility.

None of the alternatives appears to present any major administrative problems that would affect implementation. However, the flood protection dike included in Alternatives 6 and 7 would involve substantial construction in the Scioto River floodplain. Construction of the dike would remove approximately 80 acres of land from the 100-year floodplain, since the dike would prevent floodwaters from covering this area. This would increase the height of floodwaters upstream and downstream of the landfill and may cause additional areas to flood. Because of this potential problem, Alternatives 6 and 7 may be administratively more difficult to implement.

9.7 Cost

The estimated total present worth cost for Alternative 4 is approximately $4.3 million. This estimate includes capital costs of approximately $3.2 million for fencing, drainage improvements, erosion and flood control measures, and installation of the landfill cap. Annual operation and maintenance (O&M) costs for this alternative are estimated at approximately $116,000 and include expenses related to ground-water monitoring and general maintenance of the fence, drainage system, erosion and flood control measures, and landfill cap. The present worth of annual O&M costs (over a 30-year period at a 10 percent interest rate) is approximately $1.1 million.

Alternative 4 would be more expensive to implement than Alternatives 1, 2, 3, and 9. However, these alternatives would not provide the degree of overall protection offered by Alternative 4. Alternatives 5, 6, 7, and 8 would provide somewhat greater protection than Alternative 4, but at a much greater cost. Estimated total present worth costs for these alternatives range from $6.7 million to $13.8 million. Increased costs are associated with more sophisticated technologies such as a leachate collection system and gas venting system (Alternatives 5 through 8), a flood protection dike (Alternatives 6 and 7), and a landfill cap with a synthetic liner (Alternatives 7 and 8).

The total cost of Alternative 5 is approximately 50 percent higher than Alternative 4 ($6.7 million compared to $4.3 million), while Alternatives 6 through 8 involve much greater costs ($12.2 million, $13.8 million, and $8.6 million respectively). Although these alternatives may offer increased long-term protection, the relative cost increase outweighs the expected benefits. For example, the installation of a gas venting system does not appear necessary. Several factors indicate that gas generation is not a problem at Bowers Landfill. Such factors include the age of the landfill, the porous nature of the current landfill cover, the frequent flooding of the landfill, and the lack of elevated VOC and gas levels during the RI. Likewise, the installation of a leachate collection system does not appear justified because of little evidence that leachate is significantly affecting the upper aquifer. The low-permeability clay cap installed under Alternative 4 would further reduce leachate generation. The installation of a RCRA cap and flood protection dike are likewise not justified. A RCRA cap would decrease infiltration to less than 1 percent of precipitation. However, at a much lower cost, the clay cap included in Alternative 4 would decrease infiltration to less than 10 percent of precipitation. With respect to the flood protection dike, the landfill's north side appears to be stable under current conditions. It should be possible to install a new landfill cover that will resist flood damage without the added expense of a flood protection dike.

U.S. EPA has made minor revisions to remedial alternatives based on comments received during the public comment period. As a result, costs may be slightly higher than the estimates presented in this section.

9.8 State Acceptance

The State of Ohio has concurred with U.S. EPA's selection of Alternative 4 as the preferred remedial alternative for Bowers Landfill. A letter of concurrence is attached to this Record of Decision.

9.9 Community Acceptance

U.S. EPA's preferred remedial alternative for Bowers Landfill was presented at the start of the public comment period through distribution of a fact sheet, publication of display advertisements in the Cirvleville, Ohio, Herald, and placement of the proposed plan in the site information repositories. A formal public meeting to discuss the proposed plan was held in Circleville on February 28, 1989. Comments received indicate that many residents are concerned about U.S. EPA's preferred alternative.

These comments focus on three general areas. First, several residents commented that U.S. EPA appears to be closing Bowers Landfill as a solid waste landfill, with no consideration of the hazardous wastes that were disposed of at the site. These residents prefer Alternatives 7 and 8, which include additional protective measures such as a synthetic liner (in addition to the clay cap) and a flood protection dike. U.S. EPA has pointed out in this Decision Summary that relevant and appropriate portions of hazardous waste regulations in RCRA Subtitle C have been adequately considered in the design and selection of Alternative 4. This issue is discussed further in the Responsiveness Summary.

Second, several residents expressed concern about U.S. EPA's proposed ground-water monitoring plan for Bowers Landfill. These concerns are directly related to protection of public drinking water supplies -- specifically, the City of Circleville's wellfield located 1½ miles south of the landfill. To address these concerns, the ground-water monitoring program will include installing and sampling additional monitoring wells south of Bowers Landfill. Further, U.S. EPA will require that corrective action program options be developed as part of the monitoring program. This will allow prompt response if ground-water contaminant levels exceed levels of concern at any compliance point in the monitoring system.

Finally, several residents expressed concern that U.S. EPA's preferred alternative represents a conceptual design, specific elements of which will be determined later with limited input from local residents. To address this concern, U.S. EPA will consider extending the Bowers Landfill Information Committee (see Section 3.0) through the remedial design/remedial action phase of this project.

10.0 THE SELECTED REMEDY

After evaluating all the feasible alternatives, U.S. EPA is selecting a remedy that consists of five components: (1) ground-water monitoring; (2) site access restrictions; (3) management of surface debris; (4) erosion control and drainage improvements; and (5) a natural clay cover over the landfill. These five components are described in detail below.

10.1 Ground-Water Monitoring

Under Alternative 4, a long-term program will be implemented to monitor contaminant concentrations and migration. This program will include installing additional monitoring wells south of Bowers Landfill (between the landfill and the Circleville municipal wellfield) and west of the landfill (between the landfill and the Scioto River). These new wells, existing monitoring wells, and possibly residential wells near the landfill will be sampled regularly. At a minimum, the program will meet the substantive requirements for ground-water monitoring under RCRA as described in 40 CFR 264, Subpart F.

The installation of three additional ground-water monitoring well clusters is necessary to develop a ground-water monitoring program that will adequately detect potential future releases of contaminants. These well clusters will consist of three wells; a shallow well that will be located in the upper portion of the saturated alluvial aquifer, an intermediate well that will be located between the water table and the bedrock, and a deep well that will be located just above the bedrock. Two of these well clusters will be installed west of the landfill. One cluster will be installed between well location 5 and well location 6 and the other between well W-10 and the bend of the landfill (see Figure 3). The third well cluster will be installed off-site between the landfill and the Circleville municipal wellfield. The installation of well clusters in addition to these may also be considered.

The monitoring wells will be sampled on a bimonthly basis for the first year and quarterly for years 2 through 4. During the first year, samples will be analyzed for the full Target Compound List (TCL). A reduced TCL may be considered after the first year. If the levels of contaminants in ground water do not increase over this time period, the sampling schedule will be reevaluated and a reduction in the frequency of sampling may be considered. A statistical test will be developed to determine when a significant increase in the level of contaminants has occurred.

Should a significant increase in the levels of contaminants occur, it will automatically trigger a RCRA corrective action. If the levels of contaminants in ground water exceed MCLs, where available, or health-based levels, where MCLs are not available, resampling will occur within 14 days. (Health-based levels are concentrations corresponding to a cancer risk of 10^{-6} for carcinogenic contaminants and a hazard index (HI) greater than 1 for noncarcinogenic contaminants.) If the resampling verifies that there has been a significant increase in contaminant levels, a corrective action program will be implemented. Corrective action may include such measures as establishing alternate concentration limits (ACLs), collecting and treating ground water, or removing the source of contamination.

The surface water in the drainage ditch to the east of the landfill will be sampled on a quarterly basis as part of the monitoring program. Monitoring will verify that discharges from the ditch are in compliance with Ohio Water Quality Standards, as described in the Ohio Administrative Code (OAC) 3745-01. A corrective action program will be implemented if contaminant levels in the ditch exceed these standards.

10.2 Site Access Restrictions

Efforts will be made to procure deed restrictions prohibiting ground-water extraction in the field west of the landfill and restricting disturbance of the landfill surface. The viability of continued farming immediately west of the landfill will be evaluated, and, if shown to be necessary, efforts would be made to prohibit such farming by imposition of deed restrictions. A 6-foot fence will be placed around the landfill, the drainage ditch to the east, and the field to the west to limit site access. The location of the fence is shown on Figure 6.

10.3 Management of Surface Debris

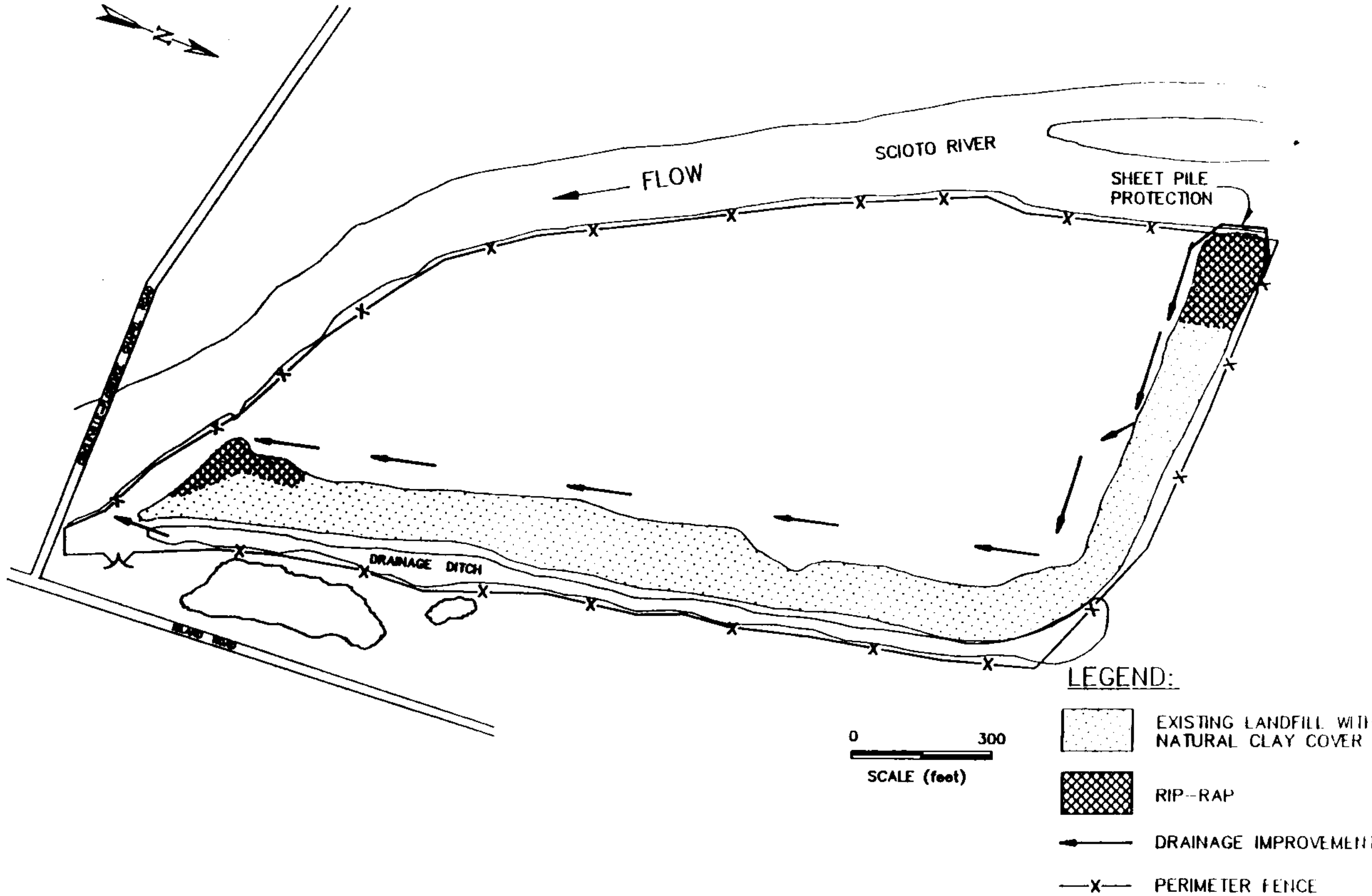
The landfill area and its immediate vicinity will be cleared of surface debris. Most of the currently exposed material consists of shredded or rolled plastic film, but rusted and partially decomposed remains of appliances, discarded tires, domestic waste, and empty drums are also evident. The visible waste items will be removed from the site by a front-end loader, placed in a lined truck, and transported to a suitable hazardous waste landfill. If the debris is determined to be nonhazardous, it will be disposed of in a solid waste landfill.

Trees on the landfill will be cut down with chain saws, and tree stumps will be ground down to the land surface. Smaller vegetation, less than 2 feet in diameter, will be cut down with mechanical equipment such as bush hogs. As much subsurface vegetation as feasible will be removed, without exposing significant amounts of waste. Exposed cover will be treated as necessary to prevent tree growth through the new cover. All vegetative material will be hauled to a local landfill unless tissue samples indicate that materials are potentially hazardous. If potentially hazardous, this material will be disposed of in an approved off-site hazardous waste disposal facility.

10.4 Erosion Control and Drainage Improvements

Erosion control will be provided for those areas of the landfill prone to the scouring effects of flood waters. The areas most likely to be subjected to these effects are the northwest

FIGURE 6. – SITE ALTERNATIVE 4



and southeast portions of the landfill that abut the Scioto River. A system of armor stone (riprap) will be used in these areas to supplement the erosion resistance provided by the new cover. This riprap will be placed on the landfill in areas shown on Figure 6. If riprap cannot be effectively placed on steeper slopes, sheet piling will be used to anchor the riprap. If sheet piling proves ineffective, a concrete wall may be used.

Site drainage will be improved to prevent ponding of water against the landfill. The area between the landfill and the river will be regraded to allow water to drain away from the landfill. The site will also be regraded to allow for drainage flow from north to south to the river.

The drainage ditch on the eastern side of the landfill will also be improved. Where necessary, side slopes will be improved to prevent erosion. The high point between the north end of this ditch and the open field north of the landfill will be cut down to prevent ponding of water against the northern part of the landfill during high-water conditions. High points within the ditch will also be cut down to allow water to drain through the ditch. Sediments removed during this process, and possibly other contaminated sediments, could be dewatered as necessary and placed on the landfill surface prior to installing the clay cap. Removal of contaminated sediments will reduce the possibility of contaminated surface water discharges from the ditch to the Scioto River. The discharge pipe at the southern end of the drainage ditch will be replaced with a larger one. A 36-inch-diameter corrugated metal pipe will be placed under the southern end of the landfill and will discharge to the river. The point where the ditch meets the pipe will be lined with compacted clay and reinforced with riprap. The pipe will have a 2 percent slope to prevent blockage with sediments.

10.5 Natural Clay Cover Over Landfill

Prior to construction of the landfill cover, a detailed geotechnical investigation will be conducted to measure the properties of the existing landfill surface and of soil and clay used for the cover. The purpose of this investigation will be to determine the stability of these materials under flood conditions. The cover will then be constructed with side slopes flat enough to provide adequate stability when the Scioto River floods. Although there is no apparent need for a landfill gas collection system, this determination could be reevaluated as part of the geotechnical investigation. A soil gas study of the landfill could verify that VOCs are not present in sufficient quantities to warrant collection.

The landfill cover will be constructed in segments to minimize potential damage due to flooding during construction. Work on one area of the landfill will be completed before construction of the next area begins. After each landfill segment has been prepared, a well compacted clay layer, at least 24 inches thick, will be placed on the landfill cap and side slopes. The clay will be added in lifts, not exceeding 6-inches, and compacted before more clay is added. The clay layer will have a maximum permeability of 10^{-7} cm/sec. Each lift will be tested according to a stringent quality assurance program to verify that this specification is met.

A top soil layer at least 24 inches thick will be placed over the clay layer (Figure 7). This layer will also be applied and compacted in 6-inch lifts. The final cover will have sufficient horizontal-to-vertical side slopes so as to prevent failure during worst case flooding conditions. The entire surface of the completed cover will be reseeded, fertilized, and watered to assure plant growth. The plant species used will have root systems that are not expected to penetrate below the upper 24 inches of cover.

The cover will be inspected and maintained on a quarterly basis. The maintenance program will include regularly mowing the vegetation on the cap; inspecting the surface for cracks, settlement, ponding, and erosion; completing appropriate repairs to the cap; and repairing the fence. Repairs to all significant damage will begin within 30 days. In addition to regularly scheduled inspections, additional inspections will be made after flood events.

The landfill will also be inspected for leachate and methane gas production on a quarterly basis. If leachate production occurs that could potentially adversely affect public health or the environment, a leachate collection system will be installed and the leachate will be collected and treated. If methane gas production occurs that could potentially adversely affect public health or the environment, a gas venting system will be installed.

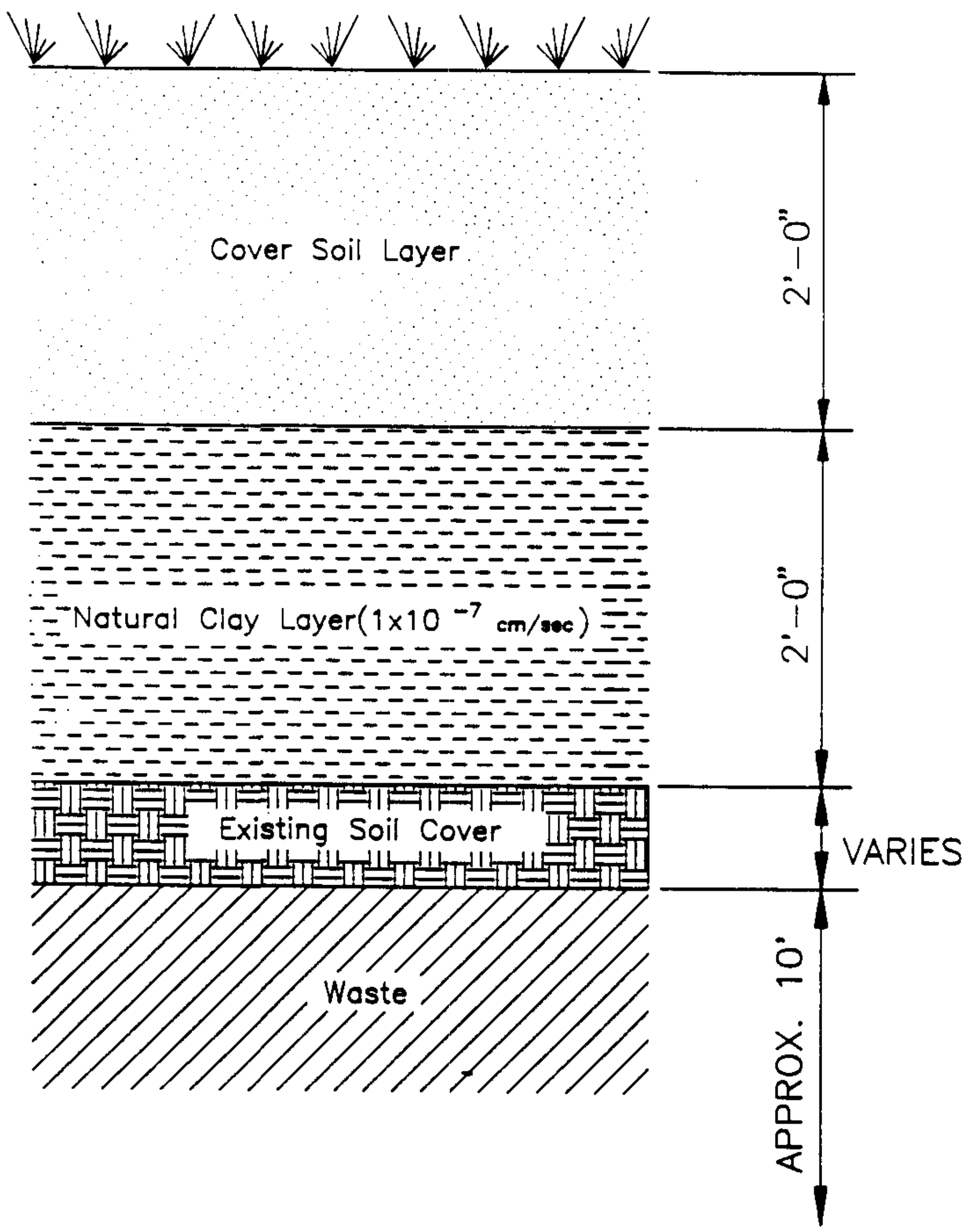
10.6 Reduction of Site Risks

The selected remedy addresses the major risks for Bowers Landfill as identified in the EA. Risks from ingesting contaminated soils will be reduced by covering the landfill (thus covering most highly contaminated soils) and by restricting access to the site. Soils in the field west of the landfill that contain lesser amounts of contamination will not be covered. The residual risks from ingesting these soils include an insignificant noncarcinogenic risk (HI of 0.24) and a carcinogenic risk of 4×10^{-8}. Risks from ingesting contaminated ground water immediately downgradient of the landfill will be reduced to zero by future ground-water use restrictions.

Alternative 4 also reduces potential long-term risks associated with the landfill. The low-permeability clay cover will greatly reduce infiltration of precipitation and flood waters, compared to the current cover. Thus, the mobility of contaminants remaining in the landfill will

FIGURE 7

DETAIL OF NATURAL CLAY COVER



be reduced. The cover will isolate waste within Bowers Landfill under a minimum 4-foot thickness of cover material and will be designed to provide long-term stability during floods.

11.0 STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Bowers Landfill site satisfies the statutory requirements of CERCLA Section 121. The selected remedy is consistent with the NCP, protects human health and environment, attains ARARs, and is cost-effective. The selected remedy does not satisfy the statutory preference for a permanent solution in that it leaves untreated waste on-site. Nor does the selected remedy reduce the toxicity or volume of wastes. However, source control and containment components of the selected remedy should significantly reduce the mobility of contaminants from the landfill.

11.1 The Selected Remedy is Protective of Human Health and the Environment

The remedial alternative selected for Bowers Landfill will reduce current and potential future risks to human health and the environment by the following means:

- Preventing exposure to contaminated soils by covering contaminated soils with a 4-foot-thick impermeable clay and soil cap and by fencing the site area. The cap and fence will be maintained on a regular basis, with an increased inspection schedule during floods.
- Preventing exposure to contaminated ground water by restricting access to downgradient property. Efforts will be made to obtain deed restrictions to prohibit extraction and use of ground water from this area.
- Limiting future ground-water contamination by reducing infiltration through contaminated soils and the landfill. The effectiveness of the cover will be evaluated by a long-term ground-water monitoring program. The program will require regular and systematic sampling of monitoring wells west and south of the landfill and possibly from residential wells south of the landfill.
- Reducing potential future exposure to wastes in Bowers Landfill by constructing a stable cover designed to withstand frequent flooding of the Scioto River.
- Reducing potential sources of surface water contamination for the Scioto River by removing contaminated sediments from the drainage ditch that is contiguous with the east side of Bowers Landfill. Discharges from the ditch will be monitored for compliance with Ohio Water Quality Standards.

11.2 The Selected Remedy Attains ARARs

The selected remedy will meet or attain all applicable or relevant and appropriate federal and state requirements. These requirements include:

- Ohio requirements for the closure of solid waste landfills (OAC 3745-27-09 and OAC 3745-27-10). The final landfill cover will exceed the required thickness of 2 feet and will meet all other substantive requirements within these regulations.

- Relevant and appropriate portions of RCRA requirements for closure of hazardous waste landfills with wastes in place. The low-permeability clay layer (maximum of 10^{-7} cm/sec) will comply with portions of the cover requirements in 40 CFR 264.301. The ground-water monitoring program will meet the substantive requirements of 40 CFR 264, Subpart F. The program will include a corrective * action component that will be triggered if ground-water protection standards are exceeded at any point of compliance in the monitoring system.

- U.S. EPA requirements for floodplain protection, as described in 40 CFR 6, Appendix A, Statement of Procedures on Floodplain Management and Wetlands Protection. This regulation requires that construction in floodplains be done in such a manner as to minimize harm to the floodplain. Construction within the Scioto River floodplain is unavoidable in implementing a remedial alternative for Bowers Landfill.

- RCRA requirements for construction, operation, and maintainance of hazardous waste landfills in 100-year floodplains. The cover installed during remedial action will be designed and engineered to prevent washout of any hazardous wastes by a 100-year flood, as required by RCRA General Facility Standards in 40 CFR 264.18.

- Maximum Contaminant Levels (MCL) promulgated under the Safe Drinking Water Act. MCLs apply to public drinking water supplies serving 25 or more people. While not applicable to ground water immediately downgradient of Bowers Landfill, MCLs are relevant and appropriate for assessing ground-water contamination levels. Current contaminant levels exceed MCLs in two monitoring wells -- benzene in one well and barium in a second well. However, average ground-water concentrations were well below MCLs. By reducing infiltration of precipitation and flood waters through the landfill, Alternative 4 should eventually reduce contaminant concentrations below the MCLs in all downgradient wells.

- Ohio Water Quality Standards listed in OAC 3745-01. Discharges to the Scioto River from the drainage ditch east of the landfill will be monitored to verify compliance with these standards.

11.3 The Selected Remedy is Cost-Effective

Alternative 4 represents a cost-effective remedial alternative for Bowers Landfill. This alternative attains the same reductions in current risks from soil ingestion and ground-water ingestion as Alternatives 5 through 8, which are considerably more expensive. Alternative 4 also provides an adequate degree of long-term protection, compared to these more expensive alternatives. Although Alternatives 5 through 8 may offer slightly increased long-term protection, the relative cost increases outweigh the expected benefits. Additional components of these alternatives, such as a gas venting system, leachate collection system, synthetic membrane cap, or flood protection dike, do not increase the effectiveness of these alternatives in proportion to the increased costs. These additional measures are not justified based on current site conditions and contamination levels.

Alternative 4 has a higher cost than Alternatives 3 and 9. However, these alternatives do not achieve either the short-term risk reductions or long-term protection offered by Alternative 4. By providing a degree of protection that cannot be achieved by less costly means, Alternative 4 is cost-effective.

11.4 The Selected Remedy Utilizes Permanent Solutions and Alternate Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

Alternative 4 is not a permanent solution to the public health and environmental problems identified for Bowers Landfill during the RI. It was not technically feasible to develop a permanent remedy for this site for several reasons. First, most of the material in Bowers Landfill consists of general refuse and municipal solid waste. Although the exact amount of hazardous waste placed in the landfill is not known, it is probably a small percentage of the total waste volume. Second, no operating records exist for the landfill. Thus, it is not feasible to identify locations where hazardous wastes might have been placed. Third, the relatively low levels of contamination found during the RI would not be effectively reduced by treatment.

Because the selected alternative is not a permanent solution and will leave wastes in place at the Bowers Landfill, the effectiveness of this remedial action must be reviewed at least once every 5 years.

11.5 The Selected Remedy Reduces Toxicity, Mobility, or Volume of Waste Materials as a Principal Element

Alternative 4 will not reduce the toxicity or volume of contaminants within Bowers Landfill. However, this alternative will reduce the mobility of waste materials within the landfill. The FS report estimates that the low-permeability clay cap included in this alternative will reduce direct infiltration into the landfill surface by over 90 percent. This is much more effective than the current soil and vegetation cover. Reducing the amount of water that contacts waste materials within the landfill should reduce the mobility of these materials and the likelihood of future ground-water contamination.

RESPONSIVENESS SUMMARY

BOWERS LANDFILL

CIRCLEVILLE, OHIO

March 24, 1989

U.S. Environmental Protection Agency

Region V

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BOWERS LANDFILL
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1.0 INTRODUCTION

The U.S. Environmental Protection Agency held a public comment period from February 14 to March 16, 1989, to provide interested parties an opportunity to comment on the Agency's Proposed Plan for Bowers Landfill. The purpose of this Responsiveness Summary is to identify major comments raised during the public comment period and to provide U.S. EPA's responses to these comments. U.S. EPA has considered all comments summarized in this document before selecting a remedial alternative for Bowers Landfill.

The Responsiveness Summary includes five sections plus three appendices. Section 2.0 briefly states public reaction to U.S. EPA's Proposed Plan. Section 3.0 contains a brief history of community interest and involvement with the Bowers Landfill site. Section 4.0 summarizes written and oral comments received by U.S. EPA during the public comment period. Comments were received from local citizens, environmental groups, local officials, state officials, and potentially responsible parties. Section 4.0 also includes U.S. EPA's responses to these comments. Section 5.0 identifies and summarizes issues that may continue to be of concern to the community during the design and implementation of U.S. EPA's selected remedy for Bowers Landfill. U.S. EPA will address these concerns during the Remedial Design and Remedial Action (RD/RA) phase of the cleanup process.

The first attachment to the Responsiveness Summary is a list of community relations activities conducted by U.S. EPA at Bowers Landfill, both before and during the public comment period. The second attachment includes copies of all written comments on the Proposed Plan received during the public comment period. Oral comments, which were recorded at a public meeting on February 28, 1989, are included within the transcript for that meeting. The transcript is part of the Administrative Record for Bowers Landfill.

2.0 OVERVIEW

U.S. EPA's preferred alternative for the Bowers Landfill site was presented at the start of the public comment period through distribution of a fact sheet, publication of display advertisement in the Circleville Herald, and placement of the formal Proposed Plan in the site information repositories. The Proposed Plan was also presented and discussed during a public meeting in Circleville on February 28, 1989. The recommended alternative addressed potential ground-water contamination problems near the site, the risk of ingesting contaminated on-site soils, and long-term risks from future contaminant releases.

The preferred alternative specified in the Proposed Plan consists of monitoring ground water at and near the site; restricting the use of the site so that drinking water wells cannot be placed between the site and the Scioto River; placing a 6-foot-high fence around the site perimeter to prevent potential trespassers from entering the site area; and installing a new clay cap on the landfill to minimize the amount of contaminants that could potentially be carried into the ground water beneath the site. Erosion control and drainage improvements would be made, and riprap and sheet piling would be placed on the north and south ends of the landfill to improve flood protection.

The comments received during the comment period indicated that residents have some concerns about U.S. EPA's preferred remedial alternative. Some residents felt additional flood protection measures were needed at the site. Concerns were also raised regarding the proposed ground-water monitoring program and response contingencies. Specific details of such a program are usually resolved in the remedial design phase. Several residents indicated concern that they would have limited future opportunities for input into the cleanup process after the Record of Decision (ROD) is signed. These residents strongly requested the continuation of the Bowers Landfill Information Committee (see Section 3.2).

All written comments received by U.S. EPA are included in Appendix A to this Responsiveness Summary. Verbal comments recorded at the February 28, 1989, public meeting are contained in the transcript of that meeting, which is part of the Administrative Record for Bowers Landfill.

3.0 BACKGROUND ON COMMUNITY INVOLVEMENT

3.1 Early Involvement

Community interest in Bowers Landfill dates back to the early 1960s when residents complained to the Pickaway County Health Department about odors and fires at the landfill. Sporadic complaints from residents continued throughout the 1960s and 1970s.

Local media covered the site during the early 1980s after Superfund was enacted and U.S. EPA became involved at the site. In April 1984, Columbus television station WMCH (Channel 4) mistakenly reported that Bowers Landfill was possibly contaminated with dioxin. The report resulted in increased interest and concern about the site. Since that time, community interest and involvement have been high. This level of interest was maintained during the remedial investigation and feasibility study (RI/FS). Appendix B to this Responsiveness lists community relations activities that U.S. EPA has conducted in response to this interest.

In early 1985, a consent order, allowing the potentially responsible parties to conduct the RI/FS, was drafted. U.S. EPA held a public comment period on the draft consent order and received written and verbal comments covering a wide range of environmental health and public involvement issues. U.S. EPA responded to these comments in July 1985. The document containing these responses (Response to Public Comments on Consent Order for the Bowers Landfill, Circleville, Ohio, July 1985) is included as Appendix C to this Responsiveness Summary.

Many of the comments on the consent order indicated an interest in greater community involvement during RI/FS process. Residents and officials wanted to be kept well informed. Some wanted representation in the decision-making process. In response to these comments, U.S. EPA established the Bowers Landfill Information Committee.

3.2 Bowers Landfill Information Committee

The Bowers Landfill Information Committee was established in November 1985. The committee consisted of representatives from U.S. EPA, OEPA, the PRPs, local (city and county) government, and citizens' groups (ACTION and L-ECHOS). The committee met regularly to discuss progress during the RI/FS and upcoming events. Draft reports were also provided to the committee for review and discussion. Committee meetings were open to any interested observers. Twelve meetings were held between November 1985 and November 1988. The committee had several major functions:

- To disseminate reports, data, and other information related to the Bowers Landfill RI/FS. During the meetings, U.S. EPA, OEPA, and the PRPs made formal presentations to the committee on topics such as well installation and sampling methods; sampling results for soil, ground water, surface water, and sediment; endangerment assessment results; applicable or relevant and appropriate requirements (ARARs); and remedial alternatives developed in the FS.
- To act as liaison between the agencies and the rest of the community.

- To provide input to U.S. EPA and OEPA on issues related to the site. However, the committee was not a decision-making body and had no authority to override agency decisions.

U.S. EPA and OEPA distributed draft versions of several documents to the committee for review and discussion. These documents were generally distributed at least one week (and often earlier) before the committee meeting at which the document was to be discussed. Site reports reviewed and discussed by the committee included:

- Work Plan
- Site Safety Plan
- Biological Survey Report
- RI Report
- Endangerment Assessment Report
- FS Report
- QA/QC Plan
- Geophysical Survey Report
- Technical Memoranda for Sampling Results
- Alternatives Array Document

3.3 Concerns Raised During the RI/FS

The following community concerns were raised during the RI/FS. Many of these concerns were expressed by the members of the Bowers Landfill Information Committee.

1. Concerns were raised by the information committee about the health and safety aspects of the RI field work. The concerns regarded coordination between agencies, PRPs, and local emergency officials should an emergency occur.

   U.S. EPA Response: U.S. EPA and OEPA officials met with local fire, police, hospital, and other officials to explain the roles of the RI participants and to better understand the jurisdictions and response capabilities of the local agencies. Response plans were developed for the unlikely event of an emergency.

2. Members of the information committee expressed a desire to physically observe on-site field activities.

   U.S. EPA Response: Due to liability concerns, this request was denied. However, slides taken during RI field activities were shown at information committee meetings.

3. Residents expressed concern that the site should be fenced to restrict site access during RI field activities.

U.S. EPA Response: The U.S. EPA Emergency Response Team evaluated Bowers Landfill in May 1985 to determine whether site access posed an immediate health threat. U.S. EPA determined that a fence was not necessary because the only unnatural materials observed at the site were empty drums and plastic nonhazardous materials. The site was almost completely covered by vegetation (grasses, shrubs, and trees). However, as a result of this evaluation, U.S. EPA installed additional warning signs at the site, particularly near the southernmost access point along Island Road.

Before the start of RI field work, a fenced area was constructed near the entrance to the landfill. Equipment used during field activities was stored inside this fenced area when not in use. The area also contained a support trailer for field activities.

4. Concerns were raised regarding the differences between the RI results and the results obtained by Burgess and Niple in 1981.

   U.S. EPA Response: U.S. EPA believes that the data obtained during the RI most accurately represents current conditions at and near the landfill. The agency also feels that the level of data quality assurance in 1981 was not as high as is present quality assurance programs offer. Therefore, the 1981 results may be less reliable than the RI results. The differences between current and 1981 results may also be explained by changes in contaminant levels due to flooding at the site or volatilization of the chemicals. Chemicals that migrated to the Scioto River would have been diluted to much lower concentrations. This issue is addressed in greater detail in Section 4.7 of this Responsiveness Summary.

5. U.S. EPA was requested to provide the results of private well sampling to the appropriate homeowners.

   U.S. EPA Response: U.S. EPA provided the results of water testing to the appropriate homeowners. The results were sent to the information repository and are also included in the RI and EA reports.

6. Residents were concerned that the Circleville water supply might be contaminated.

   U.S. EPA Response: OEPA, a party to the consent order, responded that the City of Circleville must periodically test its water supply for the presence of hazardous chemicals. OEPA placed copies of test results from 1980-1987 in the information repository.

Summaries of these test results are also included in the EA report. The results indicate that the Circleville water supply is of high quality and has not been adversely affected by contamination from Bowers Landfill. This issue is discussed further in Sections 4.2, 4.6, and 4.7 of this Responsiveness Summary.

7. Members of the group ACTION requested a formal 90-day public comment period on the RI report.

U.S. EPA Response: While a formal comment period on the Bowers Landfill RI report was not held, U.S. EPA pointed out that citizens may comment on technical activities at any time during the RI/FS process. Any comments would be included in the Bowers Landfill Administrative Record. In addition, comments on the RI submitted to U.S. EPA by members of Bowers Landfill Information Committee were included as an addendum to the RI report. A major function of the information committee has been to provide opportunities for citizen input during the technical activities at the site, particularly during the development of the work plan, and during the review of the RI, EA, and FS reports.

4.0 SUMMARY OF PUBLIC COMMENTS AND AGENCY RESPONSES

This section of the Responsiveness Summary summarizes comments received during the public comment period for Bowers Landfill and provides U.S. EPA's responses to these comments. The Agency received comments from local citizens, environmental groups, local officials, state officials, and potentially responsible parties. These comments concerned the preferred remedial alternative (Alternative 4), as stated in the Proposed Plan, and other remedial alternatives developed in the Feasibility Study (FS). U.S. EPA also received comments on work conducted earlier in the RI/FS process, including the RI and endangerment assessment.

Attachment 2 to this Responsiveness Summary includes copies of all written comments received during the public comment period. Oral comments, which were recorded at a public meeting on February 28, 1989, are included within the transcript for that meeting. The transcript is part of the Administrative Record for Bowers Landfill. Where several individuals or organizations submitted similar comments, a single response is provided. U.S. EPA has grouped the comments according to subject.

4.1 Remedial Alternative Preferences

1. Two residents asked why a flood protection dike was not included as part of the preferred remedial alternative.

   U.S. EPA Response: Based on discussions with the U.S. Army Corps of Engineers, U.S. EPA believes that the landfill cap installed under Alternative 4 can be designed and constructed to resist flood damage or washout of wastes by a 100-year flood. Alternative 4 would include flood protection, in the form of riprap, on the ends of the landfill most prone to flood damage. Where necessary, sheet piling would be added to provide additional stability. Landfill side slopes would be designed to prevent failure during flood conditions. A safe horizontal-to-vertical ratio for the side slopes would be determined by geotechnical studies of the landfill surface and the soil and clay used for the cover. Wastes would be covered by at least 4 feet of new cover material and would be isolated from flood waters. Any minor damage to the cap caused by flooding would be repaired promptly as part of an ongoing operation and maintenance program.

   The additional protection offered by the flood dike is not proportional to the cost of the dike. Although the dike would provide additional long-term protection from floods, it would provide no additional reduction in infiltration of precipitation through the landfill, compared to the clay cap. The FS estimates the cost of the flood protection dike as approximately $5.5 million. This additional component would more than double the cost of Alternative 4 while providing only slightly increased long-term effectiveness.

   Further, construction of the dike would remove approximately 80 acres of land from the 100-year floodplain of the Scioto River, since the dike would prevent floodwaters from covering this area. This would increase the height of floodwaters upstream and downstream of the landfill and may cause additional areas to flood.

2. Several residents wanted to know why hazardous waste landfill closure requirements were not applied to Bowers Landfill. A citizen representing ACTION, a local environmental group, asked: "The feasibility study states that Alternative 4 would comply with current State of Ohio closure standards for solid waste landfills. Since hazardous waste was dumped at Bowers, I would like to know if any of the alternatives comply with State of Ohio closure standards for hazardous waste facilities. If not, why not?"

U.S. EPA Response: Ohio hazardous waste regulations are modeled after U.S. EPA hazardous waste regulations. The Resource Conservation Recovery Act (RCRA), as amended by the 1986 Hazardous and Solid Waste Amendments, regulates active hazardous waste facilities. Hazardous waste facilities that were not operating after November 19, 1980, are not required to comply with RCRA. Because of this, RCRA is not applicable to remedial actions at Bowers Landfill.

U.S. EPA believes that site conditions, as currently defined by the RI, do not justify closure of Bowers Landfill in compliance with state or federal regulations for active hazardous waste landfills. The landfill was used primarily for domestic waste, nonhazardous industrial waste, and construction debris. Based on site conditions and the relatively low levels of contaminants in ground water, closure as a hazardous waste landfill is not justified.

Nevertheless, the remedial alternative chosen for Bowers Landfill takes into account several RCRA requirements for hazardous waste landfills. The low-permeability clay layer installed over the landfill will have a maximum permeability of 10^{-7} cm/sec. This cover would meet RCRA requirements for the clay liner at the bottom of a hazardous waste landfill, as described in 40 CFR 264.301. In addition, the cover will meet RCRA General Facility Standards in 40 CFR 264.18. The cover will be constructed, operated, and maintained to prevent washout of hazardous wastes by a 100-year flood. Finally, the long-term monitoring program for Bowers Landfill will comply with the substantive requirements for ground-water monitoring under RCRA in 40 CFR Subpart F.

3. Members of ACTION expressed concern that "containment techniques are unproven and unreliable technologies with specific implementation problems." Concerns were raised that containment remedies depend on expert installation, and even if properly installed, clay or synthetic membrane caps will eventually leak.

U.S. EPA Response: Capping, with either clay or synthetic membrane layers, is a standard procedure for closing land disposal units that have reached capacity. The cap serves two main purposes -- preventing direct contact and exposure to waste materials and preventing ground-water contamination by reducing infiltration of water through the wastes. The low-permeability clay cap proposed for Bowers Landfill will serve both purposes. The cap will prevent direct contact with and ingestion of contaminated soils.

The clay layer of the cap will have a permeability of 10^{-7} cm/sec or less and should reduce infiltration of precipitation and floodwaters to less than 10 percent.

U.S. EPA will take several measures to increase the effectiveness of the cap and reduce the likelihood of cap failure. First, the clay layer will be designed and installed under a strict quality assurance program. The clay will be installed in 6-inch increments (or lifts). Each lift will be compacted and tested for permeability before the next lift is added. Second, the horizontal-to-vertical ratio of the side slopes will be designed to prevent failure during worst case flooding conditions. Third, the cap will be inspected and maintained according to a regular schedule, with additional inspections scheduled after floods. If the cap leaks even after these precautionary measures are taken, the long-term ground-water monitoring program, included as part of remedial action, will detect increases in ground-water contamination before the contamination moves off-site.

4. Several residents were concerned that treatment technologies were not considered for Bowers Landfill.

U.S. EPA Response: Treatment technologies were considered in the FS, but were screened out due to effectiveness, implementability, and cost considerations. Thus, treatment technologies were not included in any of the remedial alternatives evaluated in detail. The Superfund Amendments and Reauthorization Act (SARA) of 1986 expresses a preference for remedial alternatives that include treatment as a principle element. However, treatment is not always practical, especially at sites that have large volumes of low-concentration waste materials.

Three specific factors make treatment impractical at Bowers Landfill. First, much of the estimated 130,000 cubic yards of waste material in the landfill consists of general refuse and municipal solid waste, rather than hazardous waste. Second, no operating records exist, so it is not possible to identify specific locations along the 4000-foot length where hazardous wastes may have been deposited. Third, the relatively low levels of contamination found during the RI would not be effectively reduced by treatment.

5. The potentially responsible parties commented that Alternative 3 (limited repairs to landfill cover) was adequately protective of public health and the environment, and that the selection of Alternative 4 (clay cover over the landfill) was not warranted.

U.S. EPA Response: U.S. EPA's rationale for selecting Alternative 4 over Alternative 3 is clearly stated in the ROD Decision Summary. Briefly, Alternative 3 does not meet the two threshold criteria for selection as a remedial alternative. Alternative 3 does not provide adequate protection of human health and the environment and does not comply with ARARs.

6. One resident stated that cost should not be a factor in choosing a remedial alternative for Bowers Landfill. He felt that the most expensive technologies should be chosen because they are the most protective. He stated that "EPA's rightful job at this point is to cleanup the Bowers site to the best of its ability, notwithstanding cost." This resident believed that the remedial alternative should include a synthetic membrane cover for the landfill, construction of the most sophisticated drainage system possible, and construction of a flood control dike.

U.S. EPA Response: SARA specifically requires U.S. EPA to select remedial actions that are cost-effective. Cost-effectiveness cannot be used to justify the selection of a nonprotective remedy. However, U.S. EPA is required by law to closely evaluate the costs required to implement and maintain a remedy and to select a protective remedy whose costs are proportionate to its overall effectiveness.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) provides the regulatory framework for Superfund. Under the currently proposed revisions to the NCP, cost is one of five primary balancing criteria for evaluating remedial alternatives. Other balancing criteria include long-term effectiveness; reduction of toxicity, mobility, or volume; short-term effectiveness; and implementability. To select a remedial alternative, U.S. EPA must first determine that the alternative meets the two threshold criteria -- the alternative must adequately protect human health and the environment and the alternative must comply with applicable or relevant and appropriate requirements (ARARs). U.S. EPA must then consider the balancing criteria and choose the remedial alternative that represents the best combination of these criteria. Thus, U.S. EPA must consider cost in this analysis.

7. One member of ACTION stated that a fence around Bowers Landfill, a component of U.S. EPA's preferred alternative, should be erected as soon as possible. This measure would limit exposure primarily to those who choose to become exposed.

U.S. EPA Response: U.S. EPA agrees that installing a fence around Bowers Landfill will limit exposure to those who choose to become exposed. Fencing was included in all remedial alternatives (except No Action) evaluated during the FS. Fencing will be implemented on a priority basis once remedial action begins.

4.2 Technical Concerns Regarding Remedial Alternatives

1. One member of ACTION, a local environmental group, asked about maintenance procedures for the preferred alternative. He stated that the feasibility study report did not adequately describe maintenance procedures.

U.S. EPA Response: The February 3, 1989, draft of the Feasibility Study Report, page 4-25, states:

> Maintenance of the cover would involve mowing the vegetation, inspecting the surface for cracks, settlement, and ponding of water, and making appropriate repairs. Maintenance requirements for the cover can be expected to be greater than the present cover after flood events due to the limited subsurface stabilizing capability of the grass. Damage to the cap could occur from erosion, from plant roots breaking through the surface, from subsidence due to decaying roots, from penetration by burrowing animals, or from vandalism. Direct exposure to wastes as a result of damage is unlikely because waste materials would be isolated at least 4 feet below the surface. If repairs to the clay or reseeding were required, this would be carried out immediately. Repairs to the clay would consist of patching with fresh clay.
>
> The minimum effective design life of caps is generally 20 years (K. Wagner et al, Remedial Action Technology for Waste Disposal Sites, Noyes Data Corporation, Park Ridge, N.J, 1986, pp. 19 et seq.). Proper maintenance can maintain the former effectiveness. If well maintained, there would be virtually no long-term threat to public health or the environment.
>
> The maintenance program would also include inspection of the cover for structural integrity on a regularly scheduled basis. Following periods of flooding, the landfill cover would be inspected for signs of erosion and repaired as necessary. This program would include repair of riprap protection, as necessary, and inspection for damage from scouring, wave action, and debris, together with repair as necessary.

U.S. EPA believes that the intent of the maintenance program is clearly stated in the above text. The purpose of a feasibility study (FS) is to provide a general description of remedial action technologies and to summarize the implementation methods. Specific operational guidelines that would include inspection logs, inspection schedules, inspection methods, and descriptions of corrective actions will be detailed in the remedial design (RD). The RD is intended to be a blueprint for implementation while the FS is a broader conceptual study of remedial options for the site.

2. Several residents, ACTION, the Circleville City Council, and the City of Circleville Water Department expressed concerns about long-term ground-water monitoring at the site. These concerns are related to protection of the city's water supply, which is obtained from a wellfield approximately 1½ miles south of the landfill. Specifically, commenters requested that new monitoring wells be installed between the landfill and the city's wells. Commenters also wanted to know how the proposed monitoring program would detect and prevent off-site migration of ground-water contamination. Finally, some commenters felt that testing of private wells south of the landfill and testing of the city's wells should also be included in the monitoring program.

U.S. EPA Response: Long-term ground-water monitoring will be conducted at Bowers Landfill as part of the remedial alternative. As noted above, the monitoring program will be based on RCRA ground-water monitoring requirements for active hazardous waste facilities. The monitoring program will include installing additional monitoring wells south of Bowers Landfill (between the landfill and the Circleville municipal wellfield) and west of the landfill (between the landfill and the Scioto River). The program may also include sampling of private residential wells south of the site.

Testing of the city's wells is required by federal law. Testing was conducted quarterly during 1988 for a large list of volatile organic compounds (VOCs), including eight VOCs for which there are federal drinking water standards. None of these VOCs were detected in samples from the Circleville wells. In addition, none of the VOCs found in ground-water samples from Bowers Landfill were found in the Circleville water supply. After reviewing the quarterly sampling results for 1988, OEPA informed the City that "no repeat monitoring schedule has been established by the Ohio Environmental Protection Agency (Ohio EPA) but, it is anticipated that the submittal of quarterly VOC samples will be required again in 1991."

U.S. EPA believes that the combination of these two programs (long-term ground-water monitoring at Bowers Landfill plus testing of the Circleville water supply by the City of Circleville) will result in monitoring that is protective of human health and the environment and sufficient to identify any future releases to ground water from the landfill.

3. Several residents requested that U.S. EPA provide additional details about the proposed ground-water monitoring program (for example, number and locations of wells sampled, frequency of sampling, and chemicals measured).

   U.S. EPA Response: As noted above, ground-water monitoring will require regular and systematic sampling. The monitoring program will meet the substantive requirements for ground-water monitoring under the Resource Conservation and Recovery Act (RCRA) as described in 40 CFR Subpart F.

   The installation of three additional ground-water monitoring well clusters is necessary to develop a ground-water monitoring program that will adequately detect potential future releases of contaminants. These clusters will consist of three wells -- a shallow well located in the upper portion of the upper aquifer, an intermediate well located between the water table and the bedrock, and a deep well located just above the bedrock. Two well clusters will be installed west of the landfill, one cluster between well location 5 and well location 6 and the other between well W-10 and the bend of the landfill. The third well cluster will be installed off-site between the landfill and the Circleville municipal wellfield. The installation of additional well clusters may also be considered.

   The monitoring wells will be sampled bimonthly for the first year and quarterly for years 2 through 4. During the first year, samples will be analyzed for the full Target Compound List (TCL). A reduced TCL may be considered after the first year. If ground-water contaminant levels do not increase over this 4-year period, the sampling schedule will be reevaluated and the frequency of sampling may be reduced.

4. Several residents requested additional information on the steps U.S. EPA would take if long-term monitoring results showed increases in ground-water contaminant levels.

   U.S. EPA Response: The monitoring proposed as part of the remedial alternative for Bowers Landfill will be designed to detect increases in ground-water contaminant concentrations due to the landfill. A statistical test will be developed to determine when a significant increase in ground-water contamination has occurred.

Should a significant increase in the levels of contaminants occur, the increase will automatically trigger a RCRA corrective action. If the levels of contaminants in ground water exceed MCLs, where available, or health-based levels, where MCLs are not available, resampling will occur within 14 days. (Health-based levels are concentrations corresponding to a cancer risk of 10^{-6} for carcinogenic contaminants and a hazard index (HI) greater than 1 for noncarcinogenic contaminants.) If the resampling verifies that there has been a significant increase in contaminant levels, a corrective action program will be implemented. Corrective action may include such measures as establishing alternate concentration limits (ACLs), collecting and treating ground water, or removing the source of contamination.

U.S. EPA will make every effort to minimize delays, should corrective action be needed in the future at Bowers Landfill. Details on the scheduling, timing, and nature of possible corrective actions will be addressed during remedial design.

5. One resident wanted to know the estimated costs for excavating the landfill.

   U.S. EPA Response: Excavation costs at hazardous waste sites vary according to the type of excavation equipment used, levels of worker protection required, and other site-specific factors. However, a typical cost estimate for excavation in Level B protection is approximately $60 per cubic yard. Using this figure, the total cost to excavate all of the estimated 130,000 cubic yards of waste in Bowers Landfill would be approximately $8 million. This estimate does not include additional costs for removing excavated wastes from the site, packing the wastes for removal, or treating the wastes.

6. Several residents expressed concerns that while a clay cap would reduce infiltration through the top of the landfill, leakage was more likely to occur through the bottom. Because no borings were drilled through the landfill, U.S. EPA cannot be sure that there is an adequate confining layer below the wastes.

   U.S. EPA Response: An 8- to 15-foot-thick layer of silt or clay was observed at all borings completed adjacent to the landfill. These borings indicated that a natural layer of low-permeability material was present at the time of landfill construction. Information available to U.S. EPA indicates that most waste materials were deposited directly on this layer, although some portions of this layer may have been excavated during landfilling activities.

Because Bowers Landfill does not have an engineered liner below the wastes, there is a potential for leaching from the bottom of the landfill. However, the major driving force in producing leachate is infiltration of water. The low-permeability clay cap (10^{-7} cm/sec or less) will greatly reduce the infiltration of both precipitation and floodwaters that might create leachate. Another factor that U.S. EPA considered was that leachate, when generated, would first enter the upper portion of the aquifer downgradient of the landfill. Ground-water testing during the RI showed that contaminant levels in this aquifer were very low and did not identify a leachate plume.

For these reasons, U.S. EPA believes that capping should be the first step in lessening the potential for leachate production. Capping will be coupled with frequent monitoring for hazardous constituents in site ground water. Should further ground-water testing identify leachate as a problem, then source reduction techniques, such as leachate collection and treatment, will be implemented as part of a corrective action program.

7. One member of ACTION felt that U.S. EPA's preferred remedial alternative was "the equivalent of doing nothing while waiting for rainfall and floods to flush the contaminants into the surface and groundwater."

U.S. EPA Response: As discussed in the previous response, U.S. EPA believes that the remedial alternative selected for Bowers Landfill represents an active measure to contain contaminants within the landfill, rather than allowing these contaminants to be flushed out by rainfall and floods.

8. One resident asked under "what circumstances have gas venting and leachate collection systems been recommended and how do these circumstances differ from the Bowers Site?"

U.S. EPA Response: Gas can be generated within a landfill by microbial degradation of organic materials or by volatilization of organic liquids. The period of active gas generation within a landfill can vary widely depending on site-specific conditions such as temperature, pH, moisture content of the refuse, oxygen content, and refuse composition.

In the absence of a low-permeability layer above the waste materials, most landfill gases will escape through the top of the landfill. This is most likely the case with Bowers Landfill. Wastes have been in place from 20 to 30 years and are covered with a thin layer of highly permeable soil. Further, because wastes were piled on the ground, rather than placed in the ground, the landfill has a large surface area (relative to the waste volume) for gases to escape. These observations, plus the low organic vapor concentrations measured during the RI, suggest that Bowers Landfill is not actively generating significant quantities of gas.

Gas collection and venting systems are normally installed when landfills actively generating gas are capped with low-permeability materials. Capping prevents gases from escaping through the top of the landfill and forces the gases to move more slowly in a lateral direction. Typically, collection systems are installed at the perimeter of the landfill to prevent gases from migrating off-site. However, collection systems can also be installed in the interior of the landfill. Because Bowers Landfill does not appear to be actively generating gas, a gas collection system was not included as part of the selected remedial alternative.

Leachate collection systems are required for new hazardous waste landfills as part of the bottom liner. These systems collect and drain leachate, preventing the leachate from reaching the bottom liner, penetrating the liner, and contaminating ground water below the landfill. Such a system cannot be constructed under the wastes already in Bowers Landfill.

The leachate collection system proposed for Bowers Landfill in the FS report differs from this design and would be much less effective. The leachate collection system would consist of a 1-foot-thick drainage layer of high-permeability sand and gravel. This layer would be placed on the landfill surface, before the clay cap is applied. At the edges of the landfill, where this drainage layer meets the existing land surface, a 2-foot deep trench would be dug. The drainage layer would extend into this trench.

This type of a leachate collection system would collect most of the precipitation and floodwater that passed through the landfill cap. However, only a small fraction of this water would infiltrate the low-permeability cap. The collection system would not extend down to the water table and would not collect ground water moving away from the landfill. Thus, U.S. EPA has determined that the addition of a leachate collection system would only marginally increase the effectiveness of the landfill cap.

9. One resident commented that U.S. EPA's proposed plan "fails to address the fact that a large diameter natural gas transmission line crosses the northeast corner of the site."

U.S. EPA Response: U.S. EPA is aware of this gas transmission line. However, the Agency does not believe that the presence of this line will interfere with remedial construction activities. U.S. EPA will review this issue further during remedial design. Prior to construction, U.S. EPA will conduct a field survey to confirm the actual location of the gas transmission line, as well as other underground utilities that might be present.

10. The City of Circleville commented that "both the sheetpiling protection and the amount of riprap to be installed is not sufficient given the fact that during severe floods the entire north leg of the landfill is at risk." The City also commented that "sheetpiling needs to be installed" at the south end of the landfill "to prevent undermining of the riprap in this area and the riprap itself needs to be extended considerably."

U.S. EPA Response: U.S. EPA will consider the need to extend erosion protection in greater detail during remedial design. Appendix D of the FS report contains a preliminary erosion protection analysis. This analysis identifies several areas (including those identified by the City of Circleville) that may require erosion protection beyond that included in the conceptual design of the remedial alternative. A more detailed erosion protection analysis will be conducted prior to designing and constructing the erosions protection system for the landfill cap.

4.3 Public Participation Process

1. Several residents requested that the Bowers Landfill Information Committee, which met regularly during the RI/FS process, be continued during design and implementation of the remedial alternative selected for Bowers Landfill.

U.S. EPA Response: U.S. EPA plans to continue the Bowers Landfill Information Committee during remedial design and remedial action (RD/RA). However, the makeup of the committee will vary depending on how design and construction is conducted. Three possible options are:

- Federal-lead, with the RD/RA conducted by the U.S. Army Corps of Engineers or by a U.S. EPA contractor
- PRP-lead, with the RD/RA conducted by the potentially responsible parties (PRPs) under a Consent Decree
- PRP-lead, with the RD/RA conducted by the PRPs under a Unilateral Order

Under the second and third options, U.S. EPA would oversee the RD/RA. The format of the Information Committee will be determined by the option that is chosen. U.S. EPA expects this to occur during the summer or fall of 1989.

2. One resident expressed concern that the public comment period of 30 days was not adequate and that additional time was needed for the public to review and comment on U.S. EPA's proposed plan.

U.S. EPA Response: U.S. EPA believes that a 30-day public comment period on the proposed plan is sufficient for Bowers Landfill due to the long-term involvement of citizens and citizens' groups in the RI/FS process. The public comment period began on February 14, 1989, shortly after the release of the Proposed Plan, and extended to March 16, 1989. Most of the comments received by U.S. EPA have come from individuals and organizations that have attended the Information Committee meetings, commented throughout the RI/FS, and been kept abreast of technical issues concerning Bowers Landfill.

U.S. EPA offers the following information to support the adequacy of a 30-day comment period. The Agency conducted an extensive community relations program in conjunction with the RI/FS. This program included 12 meetings of the Bowers Landfill Information Committee, where U.S. EPA, OEPA, technical representatives of the PRPs, local government officials, and citizens' groups met to keep the public informed of progress during the RI/FS. During all of these meetings, individuals from the community were allowed to ask questions through representatives on the Bowers Landfill Information Committee. U.S. EPA has responded to these questions and concerns on an ongoing basis. A draft of the FS, on which U.S. EPA based its selection of a remedial alternative, was released to the Information Committee in September 1988. Results of the FS were discussed at a committee meeting in November 1988, several months before the Proposed Plan was released.

3. One resident expressed concern that the public comment period did not offer the Circleville community "a genuine opportunity to change the EPA's position."

U.S. EPA Response: As noted above, the public has been actively involved in all aspects of the RI/FS process. U.S. EPA has received a number of comments and has seriously considered these comments. Several comments have resulted in minor changes to the preferred remedial alternative. These changes include:

- Expanding proposed ground-water monitoring at Bowers Landfill to meet the substantive requirements of RCRA.
- Installing additional monitoring wells south and west of Bowers Landfill and possible inclusion of residential wells as part of the long-term monitoring program.
- Including surface water monitoring as part of the long-term monitoring program to verify that the landfill is not affecting the Scioto River via surface water discharges.
- Lowering the permeability of the clay layer of the landfill cover to 10^{-7} cm/sec. This revised permeability is based on requirements for clay layers installed as components of RCRA landfill liners.

4.4 Costs And Funding Issues

1. Local residents expressed concern about the liability of potentially responsible parties (PRPs) for implementation, monitoring, and maintenance of remedial actions at Bowers Landfill. Specifically, residents wanted to know how this liability would be transferred if PRPs were acquired by other companies or filed for bankruptcy.

   U.S. EPA Response: Superfund liabilities are treated in much the same way as any other corporate liability. If a company with liability for a hazardous waste cleanup is sold, the buyer may or may not agree to take on the seller's liability. The debt, however, is not extinguished by the transfer of other assets. Similarly, a restructuring does not release a company from liability.

   Bankruptcy may relieve a company or individual of certain debts. Debts owed to the federal government for costs incurred during the cleanup of hazardous waste sites, however, are given a high priority among bankruptcy claims. Any funds not recoverable from the PRPs, for cleanup or operation and maintenance, would be provided from Superfund monies or by the State of Ohio.

2. A Pickaway County Commissioner expressed concern that the county did not have the funding to pay for remedial action at Bowers Landfill.

   U.S. EPA Response: U.S. EPA does not consider Pickaway County to be a PRP for Bowers Landfill at this time. If the county is not a PRP, it will not be required to fund any portion of remedial action costs.

3. One member of ACTION wanted to know who would be financially responsible should the chosen remedial alternative eventually fail.

U.S. EPA Response: The potentially responsible parties (PRPs) for Bowers Landfill would most likely be financially responsible should the chosen remedial alternative eventually fail. Section 122(f) of the Superfund Amendments and Reauthorization Act (SARA) allows U.S. EPA to grant PRPs a release from future liability at the completion of remedial action. In granting such a release, U.S. EPA would consider such factors as the effectiveness and reliability of the remedial action, the nature of remaining risks, and the extent to which the remedial action represents a permanent remedy for the site. Because the remedial action for Bowers Landfill is not a permanent remedy and leaves wastes in place, U.S. EPA would not likely grant a release from liability.

4. One member of ACTION stated that cost estimates in the FS "do not take into account the potential for astronomical increases when these impermanent remedies eventually fail."

U.S. EPA Response: The purpose of the RI/FS is to study current conditions of a hazardous waste site, to evaluate the potential effects of contaminant releases from the site, and then to propose remedial alternatives for the site that protect human health and environment. While conditions may change in the future, the purpose of the RI/FS process is to select a remedial alternative that will succeed in providing long-term protection, rather than a remedy designed to fail. Thus, the use of theoretical future conditions as a basis for estimating costs of remedial alternatives is not the intent of Superfund.

4.5 Enforcement Issues

1. One member of ACTION expressed concern that the potentially responsible parties were allowed to write the feasibility study for Bowers Landfill.

U.S. EPA Response: Section 104(a) of SARA gives U.S. EPA the authority to allow PRPs to conduct a remedial investigation and feasibility study (1) if the PRPs demonstrate their qualifications to do the work and (2) if U.S. EPA oversees and reviews the work. By allowing the PRPs to conduct the RI/FS at their own expense, U.S. EPA is able to save Superfund monies for sites where no PRPs can be identified.

The Bowers Landfill RI/FS was conducted under such an arrangement. In 1985, U.S. EPA and OEPA signed a Consent Order with E.I. DuPont deNemours & Company (DuPont) and PPG Industries, Inc. (PPG), two of the PRPs. While Dupont and PPG conducted the RI/FS, all phases of the work were reviewed and overseen by U.S. EPA and OEPA.

4.6 Remedial Investigation Issues

1. Several residents expressed concern about the adequacy of the source investigation. Specifically, they wanted to know why the amounts and locations of hazardous wastes in Bowers Landfill remain unknown. Without this information, U.S. EPA does not have the technical data to support its choice of a remedial alternative.

   U.S. EPA Response: U.S. EPA believes that data in the RI and EA reports adequately support the choice of a remedial alternative for Bowers Landfill. During the RI, a large number of samples were collected from soil, sediment, surface water, and ground water directly adjacent to the landfill. The results of all samples indicated relatively low levels of contamination, and no clearly identifiable "hot spots." Sampling results from this first phase of the RI indicated minimal migration of contaminants from the landfill. Thus, U.S. EPA determined that a second phase of the RI, which would involve collecting samples of landfilled material, was not warranted.

   U.S. EPA used a variety of sources, other than sampling, to obtain information about wastes disposed of in Bowers Landfill. These sources included historical aerial photographs, information from OEPA files, information provided by PRPs, and interviews with former owners, operators, and users of the landfill. A complete inventory of materials deposited in the landfill cannot be prepared because accurate, documented records of landfilling activities do not exist. Additionally, interviews with former owners, operators, and users were conducted 15 to 20 years after landfilling ended. Thus, the information obtained from these interviews may not be completely accurate.

   Persons interviewed stated that Bowers Landfill accepted industrial wastes, including barrels containing liquids and liquids from tank trucks. Some of these liquids may have been hazardous substances. Nevertheless, much of the industrial waste accepted by Bowers Landfill consisted of general trash and other nonhazardous wastes. Information from OEPA files (formerly the Ohio Department of Health) states that the majority of materials placed in the landfill consist of residential wastes collected by private haulers in the Circleville area.

In response to a 1978 investigation by the U.S. House of Representatives Subcommittee on Oversight and Investigation, DuPont and PPG reported disposal of 6,000 and 1,700 tons of waste, respectively, in Bowers Landfill between 1965 and 1968. U.S. EPA requested additional information from DuPont and PPG in 1988 under Section 104(e) of CERCLA. Both companies stated that they did not retain waste shipment records from the 1960s and that previous estimates of waste volumes represented the best information available. Each company interviewed employees who worked at the Circleville plants during the 1960s to obtain additional information on waste disposal from that period. DuPont stated that most of the 6,000 tons of wastes sent to Bowers Landfill consisted of Mylar polyester film. PPG responded that wastes sent to Bowers Landfill may have included defective resin products, used filter materials, resin-saturated phosphate salts, spent cleaning materials, and caustic solutions.

2. U.S. EPA received several questions and comments related to the potential migration of ground-water contamination south of Bowers Landfill. These comments included statements by several members of ACTION that one reason for the difference between RI/FS results and the 1981 findings of Burgess and Niple may, in part, be the off-site migration of a contaminant plume to the south. Since the City of Circleville's water supply wells are located 1½ miles south of the landfill, residents were concerned about this possibility. Residents were particularly concerned with movement of water in the lower aquifer at the site, and suggested that it is unlikely that water from this aquifer discharges upward into the Scioto River.

   U.S. EPA Response: The RI investigated two water bearing aquifers below the site. These two units are separated west of the landfill by a low-permeability layer. Ground water in the upper aquifer flows west toward the Scioto River and probably discharges into the river. Ground water in the lower aquifer flows southwest toward the river. The potentiometric surface (the level to which the water will rise) of the lower aquifer is higher than that of the upper aquifer and about the same as the water level in the Scioto River. Thus, ground water in the lower aquifer may move upward toward the river. However, the low-permeability layer that separates the two aquifers may underlie the river and restrict upward movement of ground water into the river. In this case, ground water from the lower aquifer will continue to move southwest. This ground water may eventually flow southward along the Scioto River, which is likely a ground-water divide. If the low-permeability layer is not continuous, ground water in the lower aquifer would likely discharge upward into the Scioto River.

Circleville's water supply comes from a wellfield, located 1½ miles south of Bowers Landfill. A number of private wells and the Sturm and Dillard quarry are located between the site and the city's water supply. Two private wells, located between the site and the quarry, were sampled during the RI. No contamination was detected in these wells. These wells and four additional wells, including three wells at the Sturm and Dillard quarry, were sampled during the 1981 Burgess and Niple study. Although the validity of the Burgess and Niple data is not completely known, no organic contaminants were detected in samples from these wells. In addition, the City of Circleville has analyzed samples from its drinking water supply wells from 1980 to the present. These results were reviewed as part of the EA. None of the results indicate that Bowers Landfill has impacted the city's water supply.

3. One member of ACTION stated that the remedial investigation was conducted "in the middle of the worst drought to affect this area in the past 60 years." He felt that these conditions could have affected the results and conclusions of the RI.

U.S. EPA Response: Climatological data from the Circleville area does not support this statement. Data from the National Weather Service in Columbus, Ohio, approximately 25 miles north of Bowers Landfill, indicate an average annual precipitation of approximately 36.97 inches. For the years 1985 through 1988, annual precipitation at Columbus was 38.67, 35.04, 26.70, and 36.57 inches, respectively. These data do not suggest extreme drought conditions, and, with the exception of 1987, precipitation in the area near Bowers Landfill was near average values.

The first round of ground-water, surface water, and sediment sampling was conducted in February 1987; the second round was conducted in April and May 1987; and the supplemental round was conducted in March 1988. None of these events occurred following periods of abnormally low precipitation. The first round of sampling actually followed a period of relatively high precipitation, as the landfill was flooded in December 1986. Additional information on precipitation and river stage data during sampling events is presented in Drawings 3-15 and 3-16 of the RI report.

4. One resident asked why the ground-water study during remedial investigation was confined to the site vicinity and did not study regional ground-water flow. Residents also asked why the remedial investigation did not include (1) testing of wells south of Bowers Landfill and (2) installation and testing of wells on the west side of the Scioto River.

U.S. EPA Response: The RI was not strictly limited to studying the site. Off-site residential wells, including two wells south of Bowers Landfill (between the landfill and the City of Circleville water supply), were sampled. Samples from these wells, as well as samples from ground-water monitoring wells, showed very little contamination. As a result, the monitoring well network was not extended south or west during the RI.

U.S. EPA will extend the monitoring well network as part of the remedial action for Bowers Landfill. The extended network will include additional monitoring wells south of the landfill, additional wells between the landfill and the Scioto River, and, if necessary, additional wells west of the river.

5. One member of ACTION questioned a statement in the RI report about potential sources of tetrachloroethene in an upgradient monitoring well.

   U.S. EPA Response: Tetrachloroethene was found in two ground-water samples collected from upgradient well W-12. Contaminants found in this well are not likely to have been caused by the landfill. The RI report (page 5-8) speculated that the tetrachloroethene found in these samples may have originated from equipment maintenance activities associated with the nearby sand and gravel quarrying operations. Tetrachloroethene is a common solvent and is widely used as a degreaser for metal machine parts.

6. One member of ACTION asked why the RI report did "not speculate what will happen to groundwater flow and the contaminants the water contains should adjacent quarrying operations reach below the water table as they have south of the site."

   U.S. EPA Response: U.S. EPA does not believe that quarrying activities near Bowers Landfill are likely to affect regional ground-water flow. Quarrying activities are continuing east and northeast of the site. At the time of the RI, these quarrying activities had reached the water table northeast of the landfill. Potentiometric surface maps of the upper aquifer indicate that flow is west toward the Scioto River, in spite of the quarrying activities to the northeast.

   Monitoring wells east and north of the landfill will be included in the long-term ground-water monitoring program for Bowers Landfill. Water level measurements from these and other wells in the monitoring network will detect any potential changes in ground-water flow direction caused by future quarrying activities.

7. One member of ACTION asked why ground-water samples were not collected from monitoring wells that exhibited elevated organic vapor readings in the well casings.

U.S. EPA Response: During the RI, a flame ionization detector (FID) was used to measure organic vapor concentrations at the top of each well casing, prior to purging or sampling the well. This procedure was used primarily to protect the health and safety of workers sampling the wells.

Only one well, P-6B, showed elevated organic vapor readings. This well was sampled in February 1987, April 1987, and March 1988. Only three organic compounds were found during these sampling rounds: benzene (2 sampling rounds, maximum concentration of 6 $\mu g/L$); acetone (2 sampling rounds, maximum concentration of 64 $\mu g/L$), and 2-methylnaphthalene (1 sampling round, maximum concentration of 2.8 $\mu g/L$).

8. One member of ACTION suggested that "background" samples for surface water and sediment were collected from locations that could have been affected by runoff from the landfill during heavy rains or flooding.

U.S. EPA Response: Background samples for surface water and sediment were collected from the east side of the Scioto River, upstream of Bowers Landfill. Sample results from these locations are not likely to have been influenced by the landfill. Surface water samples were not collected during flooding, but at a time when water was flowing from the background sampling location toward the landfill. Past floods could possibly have carried contaminated soil from the landfill, contaminating sediments away from the landfill. However, the background location would have been affected by this process only if substantial back-mixing of flood waters (flow in the upstream direction) occurred. U.S. EPA considers this unlikely.

9. During the remedial investigation, the Bowers Landfill Information Committee requested that additional deep monitoring wells be installed to clarify ground-water flow direction in the lower aquifer at the site.

U.S. EPA Response: U.S. EPA responded to the information committee's request and required the installation and sampling of two additional deep wells (P-12B and P-13B). These wells were installed in February 1988 and sampled in March 1988. Information from these two wells and other previously installed deep wells indicated that ground water in the lower aquifer flows southwest from the landfill.

4.7 Endangerment Assessment Issues

1. Two members of ACTION asked why the endangerment assessment (EA) did not consider previous sampling results from 1981. These comments focused on a 1981 study of Bowers Landfill conducted by Burgess and Niple. Ground-water samples collected during this study showed high levels of toluene, xylene, and ethylbenzene immediately downgradient of the landfill. Commenters were concerned that inclusion of these results would greatly affect the conclusions of the EA report.

U.S. EPA Response: As discussed on page 1-14 of the EA report, U.S. EPA did not evaluate the Burgess and Niple data for two reasons. First, the data were collected 6 years prior to the remedial investigation. While these data may represent past site conditions, the RI data more accurately assess current site conditions. Second, U.S. EPA could not assure the quality of the Burgess and Niple data.

Superfund endangerment assessments should be based only on validated sample results. The Burgess and Niple results were not validated and were, in some cases, contradictory. For example, samples collected from downgradient well MW-2 on July 17, 1981, showed high levels of ethylbenzene, toluene, and xylene when analyzed by gas chromatography (GC). Concentrations of these three chemicals were 66.8, 43.4, and 27 mg/L, respectively. However, when the same samples were analyzed by a different method, gas chromatography/mass spectroscopy (GC/MS), concentrations were much lower. Ethylbenzene and toluene concentrations measured by GC/MS were 2.48 and 2.53 mg/L, respectively, or 15 to 25 times lower than the GC results. (Xylene was either not measured, not detected by GC/MS, or not reported.

However, even if the EA had included the Burgess and Niple data, the conclusions of this report would not have been affected. The data would still show a potential risk from using ground water between the landfill and the Scioto River as a drinking water supply. If the highest of Burgess and Niple's results were considered, risk levels would be somewhat higher than those estimated in the EA. The hazard index, reflecting noncarcinogenic risks, would increase from 1.04 to approximately 29. Worst-case carcinogenic risks would increase from 9×10^{-6} to 3×10^{-5}.

An EA based on the Burgess and Niple results would still conclude that off-site residential wells were unaffected by the landfill. Burgess and Niple sampled six private wells south of Bowers Landfill shortly after high levels of ethylbenzene, toluene, and xylene were found in on-site wells. The private well results showed no evidence of contamination.

2. One member of ACTION wanted to know why U.S. EPA has compromised public safety by allowing a cancer risk of 1 in 10,000 for the site, a level "up to 100 times greater risk than that generally accepted."

U.S. EPA Response: This question appears to be based on a misunderstanding of information presented in the EA Report. U.S. EPA has not allowed a cancer risk of 1 in 10,000 for the site. The EA report stated that recent U.S. EPA guidance suggests that a target range for carcinogenic risks of 10^{-4} (1 cancer per 10,000 people exposed) to 10^{-7} (1 cancer per 10 million people exposed) should be considered at Superfund sites. Within this range, a risk of 10^{-6} (1 cancer per 1 million people exposed) is generally considered a benchmark for determining whether site conditions pose a significant risk. However, U.S. EPA policy is to evaluate risk levels at each Superfund site based on site-specific conditions.

In the case of Bowers Landfill, the EA report estimated that worst case risks (based on maximum contaminant concentrations and maximum exposure levels) were within the target range. Carcinogenic risks were estimated at 9×10^{-6} for ingestion of ground water adjacent to the site and 3×10^{-6} for ingestion of on-site soils. The remedial alternative proposed for Bowers Landfill should eliminate cancer risks from ground-water ingestion. By covering most contaminated soils, the alternative should reduce cancer risks from soil ingestion to 4×10^{-8}.

3. One resident was concerned that while the EA report evaluated health effects of individual chemicals, the report did not evaluate the effects of combinations of chemicals, particularly synergistic effects.

U.S. EPA Response: Approximately 60 chemicals have been identified in samples collected from various environmental media at Bowers Landfill. Because of this large number, it is not possible to identify and characterize all possible interactions of these chemicals, whether the interactions are synergistic, antagonistic, or otherwise. The EA was conducted according to established U.S. EPA guidance. This guidance requires that was conducted according to established U.S. EPA guidance. This guidance requires that when chemical interactions cannot be adequately characterized, additivity should be assumed. That is, the combined effects of two chemicals should be estimated as the sum of the individual effects of each chemical. The EA followed this procedure. For each exposure route, the effects of exposure to multiple contaminants were estimated by summing the risks for each individual contaminant.

4. One member of ACTION expressed concern that the endangerment assessment did not consider the possibility "that flooding might distribute contaminants and contaminated soil from the landfill."

U.S. EPA Response: Contaminants from Bowers Landfill, particularly those in site soils and sediments, could be distributed to off-site areas by flooding. However, transport and distribution of these contaminants by large volumes of floodwaters would greatly reduce concentrations compared to on-site levels. Risks to human health and the environment off-site would be correspondingly reduced compared to on-site risks.

The EA estimated on-site risks at relatively low levels, even under worst case exposure conditions. Off-site risks, due to possible contaminant distribution by floods, should be substantially less and well below levels of concern.

5. One member of ACTION stated that worst case exposure scenarios evaluated in the endangerment assessment weren't "really worst cases." Inhalation or ingestion of dusts while farming the field next to the landfill and ingestion of water from ditches next to the landfill were mentioned as specific concerns.

U.S. EPA Response: The EA evaluated human exposure to contaminants at or released from Bowers Landfill under probable case and worst case conditions. Exposure scenarios were developed to reflect exposure conditions that might reasonably be expected to occur at or near Bowers Landfill. This was done to identify a realistic range of risks to human health posed by the landfill. "Really worst cases" could be developed which would result in greater exposures and larger estimated risks to human health than for the realistic worst cases presented in the EA. However, such exposure scenarios are highly unlikely to occur.

For example, extensive swimming in or lifetime ingestion of surface water from on-site drainage ditches is theoretically possible. However, the ditches are shallow and filled with debris, conditions that make them unattractive as a swimming location or drinking water source. Furthermore, the general public near the landfill is well aware that the ditches are adjacent to a known hazardous waste site. Therefore, the theoretical "really worst case" exposure is extremely unlikely. The infrequent and incidental exposure to these waters, as presented in the EA, is a more realistic worst case exposure scenario.

As a second example, regular exposure to large volumes of contaminated dust (generated by agricultural activities in the field west of Bowers Landfill) is theoretically possible. Soils from this field contained lead concentrations above background levels. The National Ambient Air Quality Standard for lead of 0.0015 mg/m^3 represents a safe level for the general population. However, the EA estimated that even if all agricultural land was contaminated at the highest observed lead concentration, a total dust concentration of 15 mg of dust per cubic meter of air (mg/m^3) would be needed before lead concentrations exceeded safe levels. It is highly unlikely that such dust concentrations could be generated for any length of time, and agricultural workers would be exposed only intermittently. Exposure of off-site populations would be even less because dust concentrations would decrease during transport. Thus, as with surface water, theoretical "really worst case" exposure to contaminated dusts is highly unlikely.

6. One member of ACTION asked why the endangerment assessment ignored the possibility of southward migration of ground-water contamination.

   U.S. EPA Response: The EA stated that off-site residential wells or the City of Circleville public water supply wells have probably not been affected by southward migration of ground-water contamination from Bowers Landfill. However, the EA did not ignore this possibility. Table 3-1 of the EA presents water quality sampling results for Circleville's water system. These results, collected between 1980 and 1987, show that water from Circleville's wells is of high quality and has not been affected by contamination from the landfill. More recent and extensive data from 1988, unavailable when the EA report was written, confirm this conclusion. Sampling results from residential wells south of the landfill were also presented in the EA report. Samples collected from these wells in February 1987 showed no evidence of contamination.

4.8 Other Issues

1. One member of ACTION wanted to know why the size of Bowers Landfill was listed as 80 acres in 1980, but only 12 acres in subsequent reports.

U.S. EPA Response: The 12-acre figure refers to the area where wastes were deposited. This L-shaped area, shown in various site drawings, is approximately 4,000 feet long and 125 feet wide. The 80-acre figure refers to the entire site area, including the landfill, drainage ditch to the east, and the agricultural field to the west. This area will be enclosed by a fence as part of the remedial action.

2. One member of the community expressed health concerns about "a higher than normal incidence of sickness" near the landfill. Another member of the community asked whether U.S. EPA "has done any studies to see if the incidence of cancer and leukemia in the youth of Circleville is greater than in similarly sized towns elsewhere."

U.S. EPA Response: U.S. EPA has not conducted any epidemiological studies of this type at Bowers Landfill. These studies are normally conducted by the Agency for Toxic Substances and Disease Registry (ATSDR). Based on Superfund Amendments and Reauthorization Act of 1986, ATSDR is required to perform a health assessment at each Superfund site. The health assessment is conducted independently of U.S. EPA's EA and is a preliminary evaluation of risks posed by the site. Depending on the results of this assessment, ATSDR can conduct pilot studies of health effects for selected groups of exposed individuals or a full-scale epidemiological study of exposed populations. ATSDR maintains an office at U.S. EPA Region 5 headquarters in Chicago. Questions on ATSDR's role and on epidemiological studies should be directed to Louise Fabinski at that office. She can be reached at (312) 353-8228.

5.0 REMAINING CONCERNS

U.S. EPA was unable to completely address several issues during remedial planning activities associated with the Record of Decision. These issues and concerns are summarized below.

Details of the ground-water monitoring program. U.S. EPA's Record of Decision provides details on several aspects of the ground-water monitoring program. These details include approximate locations of new wells, the list of chemicals to be sampled, and the sampling frequency. Additional details, including the exact number and locations of new wells and the wells to be included in the ground-water monitoring program, will be developed during remedial design.

Response plan for detection of contaminants in monitoring wells. Concerns were raised about the lack of a response plan if monitoring wells show increasing levels of contamination, once the clay cap has been installed on Bowers Landfill. Major issues included the contaminant levels that would trigger a response, the nature of the response, how quickly the response would occur, and who would be technically and financially responsible for the response. U.S. EPA has addressed these issues to the extent possible in the Record of Decision. Additional details will be resolved during the detailed design of the site remedy.

Operation and maintenance plan for landfill cap. Several residents expressed concern about procedures that will be used to ensure the integrity of the landfill cap. In the Record of Decision, U.S. EPA has provided a general description of operation and maintenance requirements for the cap. For example, the cap will be inspected quarterly, and repairs to all significant damage will begin within 30 days. Additional specific details must be determined after the cap is designed and constructed. Examples of such details include inspection methods and reporting procedures.

Construction of a fence around Bowers Landfill. Residents requested that a fence around the Bowers Landfill site, a component of the selected remedial alternative, be constructed as soon as possible. U.S. EPA will construct the fence on a priority basis during remedial action. However, the Agency cannot provide a specific schedule for fencing the site at this time.

Continuation of the Bowers Landfill Information Committee. Several residents requested continuation of the information committee to facilitate citizen involvement in the RD/RA process. U.S. EPA will continue the committee. However, the exact makeup of the committee will depend on negotiations with the PRPs. The results of these negotiations will determine who will be responsible for design and construction of the remedial alterative, and, thus, who will be on the committee.

APPENDIX A

WRITTEN COMMENTS ON THE PROPOSED PLAN FOR BOWERS LANDFILL

**Comments Submitted at the
Public Meeting on
February 28, 1989**

Name [illegible]
Address 711 Island Road
Ashville Oh ZIP 43103
Affiliation ACTION
Phone 614-474-1240

Question:

Name Amy Brown
Address 9230 Maple St
Stoutsville Oh ZIP 43154
Affiliation Concerned Mother & Citizen
Phone 474-2507

Comment ~~Question~~: WITHOUT YOUR HEALTH YOU HAVE NOTHING AND IF YOU PUT A PRICE ON THE PROTECTION OF IT YOUR ALTERNATIVE ~~s~~ IS LACKING. I BELIEVE THAT IF YOU GO WITH ANY OF YOUR ALTERNATIVES YOU CANNOT POSSIBLY MONITOR THE LEAKAGE WELL ENOUGH OR WILL NOT CHECK IT OFTEN ENOUGH TO BE ABLE TO AVOID FURTHER CONTAMINATION UNTIL IT HAS GONE TO WHAT WE ALL HOPE

AND PRAY WILL NEVER HAPPEN - CONTAMINATING OUR HUMAN LIFE. LETS TAKE ANOTHER LOOK AT SOME ALTERNATIVES THAT ARE MORE REASONABLE ~~AND~~ FOR PREVENTATIVE REASONS AND NOT WORRY SO MUCH ABOUT WHAT THE ULTIMATE PRICE WILL BE FIRST. IF THE OWNERS ARE TO COVER THE $ AMOUNT WHY NOT DO THINGS RIGHT.

Name PAUL W TURNER

Address 13235 WINCHESTER RD.

ASHVILLE, OH. ZIP 43103

Affiliation ACTION

Phone 614-474-1240

Question: Why is the continuation of the Bowers Landfill Community Information Committee under consideration?

Name [illegible]

Address [illegible]

[illegible] ZIP [illegible]

Affiliation [illegible]

Phone [illegible]

Question:

Name PAUL W. TURNER

Address 13235 WINCHESTER RD.

ASHVILLE, OH ZIP 43103

Affiliation ACTION

Phone 614-983-2172

Question: My concern is with the synergism of the contaminants. We have been told that the levels of individual chemicals are within acceptable risk.

What is the affect of the combination of these contaminants?

Name George Hamrick
Address 420 Glenmont Ct
Circleville Oh ZIP 43113
Affiliation County Commissioner
Phone 614-474-2037

Comment· ~~Question:~~ I would hope that continued monitoring will take place.

Also if any increase in movement or degree of toxicity, action would be taken

Finally - dollars are important, our county does not have the money that you are speaking of. We need your continued help.

Name John Stelorz
Address 437 North Court St.
Circleville OH ZIP 43113
Affiliation Citizen of Circleville
Phone

Question: What are the estimated costs of excavation of Bowers Landfill?

Name [illegible]

Address 15446 [illegible] Rd. [illegible]

ZIP [illegible]

Affiliation A. C. T. I. O. N.

Phone 983-3206

Question: Once contaminents from Bowers Landfill starts spreading who will be paying for the clean up!

Name GARY L. GILLEN M.D.

Address 6803 HAGERTY RD.

ASHVILLE, OHIO ZIP 43103

Affiliation ACTION

Phone

Question:

Name Ann Hark

Address 609 Plaza Drive

Circleville, Ohio **ZIP** 43113

Affiliation ACTION

Phone 474-3544

Comment: ~~**Question:**~~

1. It is my opinion that problems are much more likely to occur as a result of leakage from the bottom of the site. This problem is completly ignored by all nine "preferred alternatives".

2. In reference to the question/comment made by Cindy Gillen: due to a technicality of the law (since the fill was not in use in 1980) we are not being given a remedy to our problem of toxic waste.

Name DUNKEL RALPH E.

Address 6141 ASH-FAIR-RD

ZIP 43103

Affiliation NUMEROUS

Phone 614-983-3239

Question: IT SEEMS TO ME, THAT IF SOMEWHERE DOWN THE LINE, SOME TOXIC FROM BOWERS LANDFILL GETS INTO PRIVATE OR PUBLIC WATER SUPPLIES RESULTING IN HEALTH PROBLEMS... SOMEONE SHOULD BE HELD LEGALLY AND FINANCIALLY RESPONSIBLE..

INDIVIDUALS OF ~~THE~~ E.P.A. (WHO PARTICIPATED IN HEARINGS .. THE ENGINEERING CO, THAT CONDUCTED TESTS ETC.

Name Stuart Edwards

Address 7014 Hiawatha Ave

Cincinnati OH ZIP 45227

Affiliation Dames & Moore

Phone 513 651 3440

Question:

Name John R Adkins

Address 18125 Winchester Rd

Ashville Oh ZIP 43103

Affiliation Attorney

Phone 614 474 3157

Question: The alternatives inaccurately assumes that the waste will be encapsulated with impermeable clay. A likelihood exists that leaching will occur therefore the most important aspect - future intervention and remediation of toxins to assure protection. Major plan components well testing, freq. of analysis, interdiction plans have not been addressed.

Worst case scenario.

Sufficient adjacent area perimeter

Liability not released

Same bureaucratic responsibility that existed of Fernald

Monitoring published

Unfair to landowners to [illegible] not present

Additional Written Comments
Submitted by Citizens
During the Public Comment Period

Memo Regarding Bower's Landfill Cleanup
To: U.S. Environmental Protection Agency
From: John Payne, Area Resident
1665 Winding Road, Circleville, Ohio 43113

My name is John Payne, and I live in Circleville Township approximately 1/2 mile north of the City limits. The purpose of this letter is to state my feelings with respect to the options available to the USEPA and the USEPA's preferred option for cleaning up the Bower's Landfill Site.

The Circleville Herald recently reported the consideration by the U.S. EPA of nine cleanup options for the Bower's Site, and it also identified the option preferred by the U.S. EPA. The purpose of the reporting was to make public notice of the issue and of a public hearing to be held at 7 p.m. on February 28 in Circleville. I respectfully request that you accept my comments as part of the record of the February 28 meeting.

To respond to this issue and the cleanup options presented, I would like to begin by focusing on the issues that appear to be realistically open to discussion. To do that, I think it makes sense to eliminate options 2, 3, and 9 from consideration. These options reportedly do not comply with Ohio's landfill closure standards. I assume there was a logical explanation for including these options, but from a practical standpoint it does not make sense to discuss them. Option 1 is automatically eliminated as it is provided only as a basis of comparison.

The remaining options to be considered are numbers 4, 5, 6, 7, and 8. Within these options, the following matters appear to be the major differences which deserve further exploration:

- Cost
- Covering
- Drainage
- Flood Control.

I assume the issue of cost is very difficult to isolate. After all, I do not believe that we have had a great deal of experience in actually cleaning up hazardous waste sites as opposed to studying them. I am suggesting simply that cost should only be considered in a very general nature until evidence is presented which justifies more confidence in the numbers.

The choice of a covering mechanism essentially consists of two options: 1. A 24 inch clay cover under a 24 inch layer of top soil, or 2. The same as the first option except a synthetic membrane is installed over the clay and under the top soil. The U.S. EPA prefers the clay cover only option. I believe that the fact that the synthetic membrane option exists suggests that it is a safer, more effective method for covering the site. Therefore, without consideration of cost, the preferred option for area residents is simple - install the membrane cover.

Drainage options range from a simple drainage ditch with a new corrugated metal pipe to a leachate collection and gas venting system. The drainage pipe option should undoubtedly be much less expensive. This is the option preferred by the U.S. EPA. However, several questions are raised by the simple availability of the other options. First, where will the drainage ditch take the runoff? Does it matter? Next, what is the cost estimate for correcting a problem ten years or so from now if the gas collection problem becomes serious? What are the possible health consequences to the City? Finally, in what circumstances have gas venting and leachate collection systems been recommended and how do those circumstances differ from the Bower's Site? Again, the option most wanted by Circleville area residents is simple - construct the most sophisticated drainage system possible.

The flood control issue pertains mostly to the decision of whether or not to build a dike to protect the site from the Scioto River. The U.S. EPA does not prefer this. Building a dike would increase the cost of the cleanup considerably. Again, however, the fact that this option exists suggests that the construction of a dike improves the cleanup to some degree. Once again, without consideration of costs, the preferred option for area residents ought to be to build the dike.

It is apparent that the U.S. EPA has opted to recommend a cleanup procedure that meets the minimum standards allowed by the Superfund law and costs the least to implement. This indicates to me that their primary decision point is money, which is the least important consideration (I hope) for area residents. This difference probably encapsulates the conflict that I believe will exist at tonight's meeting.

Moving away from what appear to be the readily apparent discussion points, I would like to make some comments about my desires for the final option selected. First, with respect to the notice in the Herald, it is stated that, "Most contaminants were detected at levels considered safe...." This evokes the obvious questions concerning who did the testing and, more importantly, which chemicals were found to be unsafe. In addition to that rather frightening statement, the notice asserts that, "The endangerment assessment indicated that the overall risk posed by the site is low." It goes on to say, "The landfill does pose a threat of future contaminant release." These statements concern me.

I assume the more extensive the cleanup operation is, the lower the risk. If the EPA is asking what level of risk we are comfortable with, the answer is, of course, the least possible. I also assume that the threat of future contaminant release is lessened with each additional cleanup measure adopted. Again, we are naturally most comfortable with the cleanup option that leaves us with the least threat possible. This logic should prevail among Circleville area residents, and it sort of begs the question of why we are having a hearing process at all. Are we to believe this is a genuine opportunity to change the EPA's position?

Just in case the EPA is listening, I would like to put this situation in a more personal perspective. First, my wife and son drink Circleville water (at school, stores, etc.). The value of their health to me is higher than the value of all the other alternatives the U.S. government could spend our tax dollars on. When my son takes a drink at school, am I supposed to be comforted by knowing that the chances of the water being lethal are low? On a more selfish matter, the value of my house is very important to my family as well. When I try to sell my house, am I supposed to tell prospective buyers that our neighborhood Superfund site only poses a low threat of contaminant release?

Naturally Circleville area residents are far more concerned about their local environment than with the economies of cleaning up such an extensive site. This does not mean we do not understand the many other demands being made for federal money. It simply means that we expect the health and welfare of decent, taxpaying citizens to come first. I believe that the EPA's rightful job at this point is to cleanup the Bower's site to the best of its ability, notwithstanding cost. Then the EPA should pursue settlements from the potentially responsible parties involved in this matter with great tenacity. The threat created by the EPA's enforcement activity on the financial health of local companies and area employment is diminimous compared to the threat the site poses to our health and lifestyles.

To close this letter, I would like to state, in general terms, my position as just one citizen in the Circleville area. First, I believe that the technical discussions that will take place at the February 28th public meeting regarding types of chemicals, soil content, etc. are moot. We know the Bower's Landfill Site is horrible simply by its status as a Superfund Site. I do not see how the degree of horror is pertinent. Second, I would suggest to area residents and our elected officials that this is a time for activism, not conservatism. We have an opportunity to take care of this problem the correct way, to better ensure that our grandchildren and their grandchildren do not die horrible toxic related deaths, and to better ensure that our community continues to thrive.

It is time for all ordinary citizens to stand up and fight. It is not what we ought to do; it is what we have to do. We must push for the most comprehensive cleanup possible. As a person like many others in this area who loves Circleville, the truth behind this issue tears at my heart - allow the Bower's Landfill Site to show dangerous levels of leakage in the future, and Circleville will die completely, not partially.

Georgette Nelms
USEPA Rgion 5
230 South Dearborn
Chicago, Ill. 60604

Dear Ms Nelms,

Because I have lived in the area called Bowers Landfill before any dumping began, I am greatly concerned about clean up being done correctly for protection of the people in the Pickaway County area.

District Soil and Water representative Mark Scarpitti presented valid conflicting evidence about groundwater flow off-site. The EPA did not study groundwater flow outside the immediate area of the site and could be making a serious inaccurate assumption about potential risks to our water supply.

Montoring wells should be installed between the site and city wells. Previous testing at the site showed high levels of contaminats in leachate and groundwater in 1980 and 1981.

EPA has not drilled into this site to determine the location of wastes but is proposing a remedy to contain something. This site floods frequently which presents great potential for contaminant migration since its clesure in 1968. EPA should require testing further out from the site until contaminats are located if not located at the initial test sites.

If no further testing is going to be conducted at least a flood protection dike should be installed.

Since EPA admits that if Bowers Landfill had operated after new laws had been put into effect it would be subject to stricter cleanup requirements why not use these new requirements on your own to protect the drinking water of the people in Circleville? If our local and state health departments had done their job starting in 1958 the recent testing and further testing would not be necessary now. Please do a complete job NOW!

Sincerely,

Ann Short
PO Box 307
Circleville, Ohio
43113

Ann Short
P.O. Box 307
Circleville, Ohio 43113

COLUMBUS, OH 430
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4 MAR
1989

Ms. Georgetta Nelms
USEPA Region 5
230 South Dearborn
Chicago, Ill. 60604

PA

GFWC CIRCLEVILLE JUNIOR WOMEN'S CLUB
CONSERVATION COMMITTEE

March 12, 1989

Dear Ms. Neims,

Please take note that as a member of the Circleville Ohio community, I am very concerned about the proposal for the containment of the Bowers Landfill. I have worked with a number of the people who live close to the landfill and they all have nothing good to say about the area. They also seem to have a higher than normal incidence of sickness. If this is due directly to the landfill I cannot say for certain but from what I have read on the topic, you do not know that it is not making them more at risk.

I urge you to do everything in your power to make the clean-up of the sight, the toughest possible. In the long run, it will be cheaper to do it now than to have to pay to do it again later. It will also be cheaper do the best possible job now, then it will be to pay for the medical bills incurred down the road from the residents.

This is the only America we have and to destroy it by careless dumping and then to not take every measure to correct our mistake is really stupid. What are we leaving our children if they can't drink the water?

Sincerely,

H. Pat Whalen-Shaw

H. Pat Whalen-Shaw

recycled paper

M. & P. WHALEN-SHAW
7041 ZANE TRAIL RD.
CIRCLEVILLE, OH 43113

U.S. POSTAL SERVICE O.C.
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1989

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Georgette Neims

USEPA Region 5

230 South Dearborn

Chicago, IL 60604

March 12, 1989

To those it may concern,

The Action Committee of Circleville is certainly not kidding when they tell you about the land fills in Pike County. I have lived here for 70 years & every word they tell you is the truth. Please check out our water safety with your drilling that you know how to do.

We want something done about this now.

Yours Truly —

Raymond Hott
Audrey Hott

Raymond Hott
[illegible] Club Dr
Circleville Ohio
43113

Georgette Nelms
USEPA Region 5
230 S. Dearborn
Chicago Ill. 60604

PA

Circleville, Ohio
March 13, 1989.

Dear George H. Nelms,

We live near the Bowers Landfill or hazardous waste site. We feel that a flood protection dike should be installed at the very least. Please use every precaution possible in closing this site. We need safe water and air.

Sincerely,
Mary Short.

712 North Court Street
Circleville, Ohio 43113
March 13, 1989

Georgette Nelms
USEPA Region 5
230 South Dearborn
Chicago, Illinois 60604

Dear Ms. Nelms:

In the interest of safety and good health for the citizens of Circleville, and also for property values, I feel some action should be taken to assure that the drums of chemicals that are buried in Bowers landfill should be removed. Or, possibly, some other method should be devised to make sure that the chemicals do not escape the landfill and get into our water supplies.

Has the EPA done any studies to see if the incidents of cancer and leukemia in the youth of Circleville is greater than in similarly sized towns elsewhere?

Another thought occurs to me that the first report on contamination from Bower's landfill stated that it was almost as bad as Love Canal in New York. The later report indicates it is not nearly that serious. Was the first report done? Was the second report wrong? Or did the chemicals somehow escape? Or, is the super-fund drying up for clean-up?

Thank You,
Heather D. Lynn
HEATHER D. LYNN
Don Lynn
DON LYNN
Dorothy Lynn
Dorothy Lynn
Lonnie Smith
Lonnie Smith

712 N. Court St.
Circleville Ohio 43113

COLUMBUS, OH 430
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Georgette Nelms
USEPA Region 5
230 South Dearborn
Chicago, Illinois 60604

RA

JOHN E. BOWERS
ATTORNEY AT LAW
233 NORTH COURT STREET
CIRCLEVILLE, OHIO 43113
(614) 477-1361

March 13, 1989

U.S. Environmental Protection Agency
ATTN: Mr. David Wilson (5HS-11)
Remedial and Enforcement Response Branch
230 South Dearborn
Chicago, Illinois 60604

Re: Bowers Landfill site, Pickaway County, Ohio

Dear Mr. Wilson:

The following comment is submitted regarding proposed plan and feasibility study for the above referenced site:

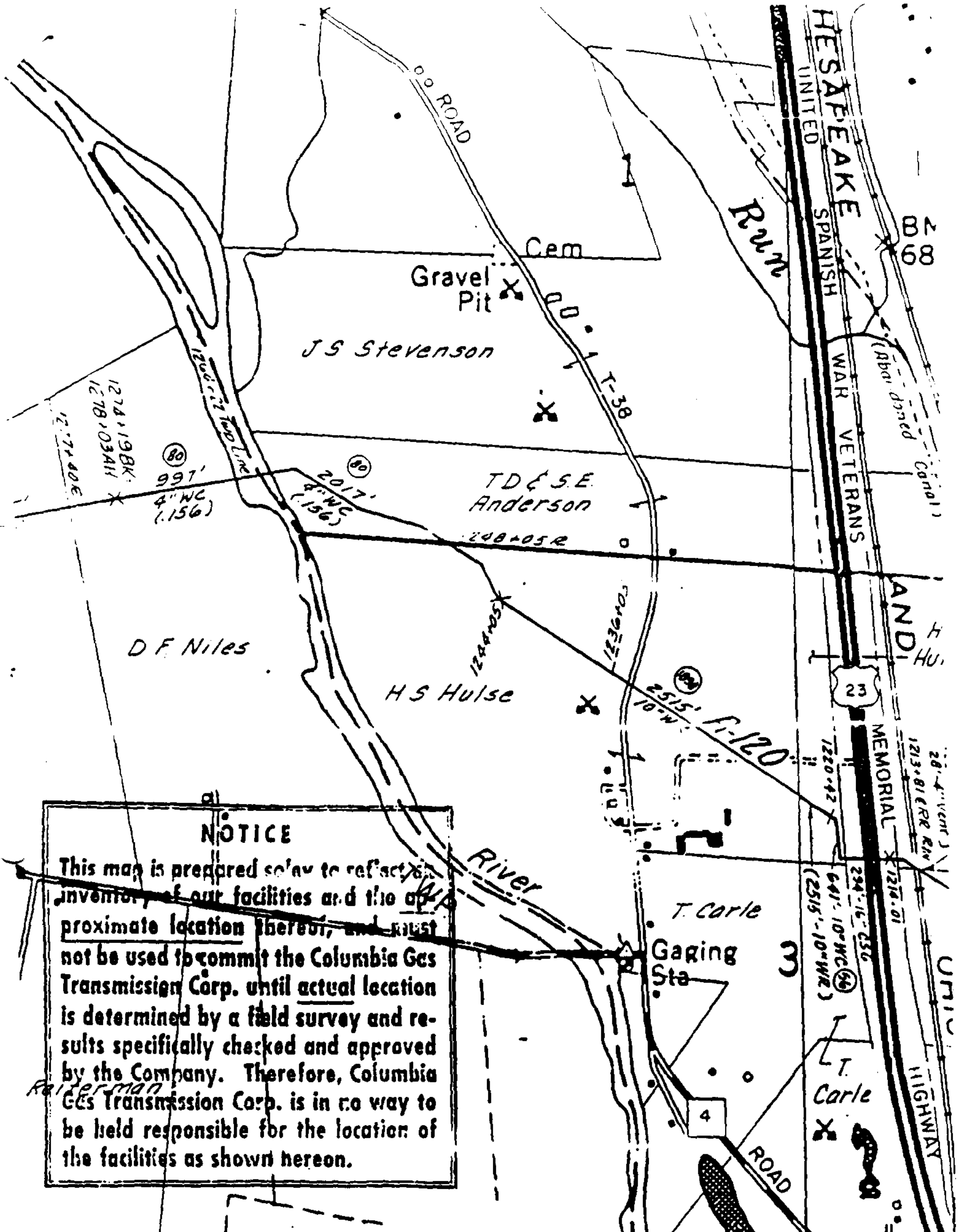
The proposed plan fails to address the fact that a large diameter natural gas transmission line crosses the northeast corner of the site. This line is owned by Columbia Gas Transmission Corp. and is designated as Line A-120. A map indicating the location of this line is attached hereto.

Please contact me if you wish to discuss this matter further.

Yours truly,

John E. Bowers

JEB/cm



NOTICE
This map is prepared solely to reflect an inventory of our facilities and the approximate location thereof, and must not be used to commit the Columbia Gas Transmission Corp. until actual location is determined by a field survey and results specifically checked and approved by the Company. Therefore, Columbia Gas Transmission Corp. is in no way to be held responsible for the location of the facilities as shown hereon.
ROAD
Cem
Gravel Pit
J S Stevenson
T-38
Run
HESAPEAKE
UNITED SPANISH WAR VETERANS MEMORIAL HIGHWAY
BM 68
(Abandoned Canal)
TD & S.E. Anderson
D F Niles
H S Hulse
991'
4" WC
(.156)
2017'
4" WC
(.156)
2515'
10" W
F-120
23
River
T Carle
Gaging Sta
3
4
ROAD
T. Carle
641' 10" WC
(2515' 10" WC)

March 13, 1989
271 Clark Dr.
Circleville Ohio 4311[illegible]

Georgette Nelms
U.S. EPA Region 5
230 South Dearborn Chicago Ill. 60604

Dear Georgette Nelms

We in Circleville and Pickaway County feel we are in Catch 22 with no return.

The Bowers landfill is worse than the Love Canal - toxic waste. We want from USEPA potential problems presented by our neighborhood Superfund site corrected and controlled by a fence around the site and monitoring the wells between the site and the City's wells field should be immediately installed regardless of any cleaning decision - which should have been done 5 years prior to any Superfund study.

We as people at least need this protection, if it isn't already too late -

Sincerely,

2

This matter lies on your shoulders to protect us from toxic water in the underground water of our wells.

We know you will help us now before its late - if it isn't already.

Thanks

Vera Saunders
271 Clark Dr
Circleville Ohio 43113

Georgette Nelms
USEPA Region 5
230 South Dearborn
Chicago Illinois 60604

Telefax

Georgetts Nelms
U.S. Environmental Protection Agency
Region 5
Office of Public Affairs (5PA-14)
230 South Dearborn Street
Chicago, IL 60604

March 15, 1989

Dear Georgette:

The EPA studies of the Bowers hazardous landfill site have dealt almost exclusively with the groundwater flow at the site and have failed to account for the likely event a good portion of the chemicals have moved offsite. Due to the frequent flooding of the area and due the porous nature of substratum below the dump, ie. gravel and sand, there is a high probability that large amounts of the toxics moved offsite years ago. Since the contaminants have a half life of hundreds of years and are not dilutable in water, they still exist. Additionally, these chemicals tend to bind to one another in a "plug of concentration". Where is the Bowers landfill plug of concentration?

The cleanup plan addresses the original dump site only and does not safeguard the city of Circleville's water supply from this plug of concentration. It is a mistake to consider a treatment of the original site as a solution. Circleville water wells must be safeguarded with a ring of monitoring wells around the city well fields and constant analysis of the pumped water. Without these safeguards, the physical and economic health of Circleville is in jeopardy.

Sincerely,

Timothy Kramer
405 Ridgedale Drive
Circleville, Ohio 43113
Phone (614) 474-3092

Kramer
405 Ridgedale Drive
Circleville, Ohio 43113

Georgette Nelms
U.S. Environmental Protection Agency
Region 5
Office of Public Affairs (5PA-14)
230 South Dearborn Street
Chicago, IL 60604

3/15/89

Dear Mrs Nelms,

Our family lives in Circleville, OH and are concerned by the EPA's plan for the cleanup of Bowers Landfill.

The EPA's plan of containment is not in the interest of the people of Circleville. It is only a quick fix. The people here need a permanent remedy or Circleville will cease to exist.

The EPA has settled for a 1 in 10,000 cancer risk in Pickaway County while a 1 in 1 million cancer risk is commonly used in Superfund. Also Superfund site cleanups average $500,000 to $1 million per acre. While the proposal for Bowers Landfill is $350,000 per acre.

Bowers Landfill is near the city's water wells and the Scioto River. However, the EPA has no plans for monitoring wells or only limited monitoring that will be reduced in the future.

The EPA's attitude seems to be hasty, just to be finished with this problem. We say do it right in the beginning. We are against the EPA's plan and hope our objections will be recorded.

Thank you

Ron Lieberman

Linda J Lieberman

517 Elm. AV

517 Elm Av
Circleville, OH.
43113

PM 6
15 MAR

Georgette, Velms
USEPA Region 5
230 South Dearborn
Chicago, Ill 60604

PA

Mr. & Mrs. William Bookout
576 Springhollow Road
Circleville, Ohio 43113
15 March 1989

Dear MS G. Helms:

We are writing in regards to the Bowers Landfill problem here in Circleville. Our aAction Committe, thinks the EPA plan is flawed. We are in complete agreement with them.

Please give us a break and MAKE a complete cleanup of this mess. Before someone dies for our governments mistake.

Sincerely
William J. Bookout
WILLIAM J. BOOKOUT

ANNA M. BOOKOUT
Anna M Bookout

R WILLIAM BOOKOUT
76 SPRINGHOLLOW RD
IRCLEVILLE OH 43113

COLUMBUS, OH 430
PM
15 MAR
1989

SAVE
YOUR VISION
WEEK

GEORGETTE [illegible]
USEPA Region 5
230 South Dearborn
CHICAGO, ILLINOIS 60604

March 16, 1989

To Whom It May Concern,

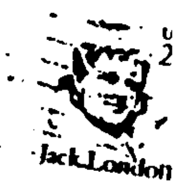
We, the undersigned, must strongly protest the methods by which the USEPA is deciding to "fix" the Bowers Landfill. It will not solve the problem of protecting our water supply in Circleville, Ohio. Our water must be protected at any costs! We must have monitoring wells between the site and the City well field. We must also have more monitoring at the site itself. After all, we live here, the ones involved in the USEPA don't! They don't have to worry about their children's 1 in 10,000 risk of Cancer that they're allowing for Pickaway County!

Mr. & Mrs. Danny L. Rose

Mr. & Mrs. Elmer Lowery

Mrs. Virginia Christman

PO Box 255
Circleville, Ohio
43113



Georgette Nelms
USEPA Region 5,
230 South Dearborn,
Chicago, Illinois
60604

PA

J. L. Parish
District Agent & Registered Representative

Mr. Nelms,

I respectfully request that every measure possible be used to "cleanup" the Bowers Landfill Superfund site in Pickaway Co. Ohio. As a life-long (48 yrs) resident of this community I'm greatly disturbed by the rising incidence of cancer. I received correspondence approx 5 yrs ago from the American Cancer Society (of which I am a member) stating that only the city of Cincinnati has a higher incidence of cancer than Pickaway County. Please help us!

- Sincerely

Jerry & Barbara Parish

Comments from ACTION
(a Local Environmental Group)

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113

Office Hours: Wednesday 9 a.m. - 2 p.m.
Office Phone: 1-614-474-1240
Recordaphone will answer at other times.

TO: Erin Moran, Project Director, USEPA Region 5

FROM: Gary L. Gillen, M.D.
ACTION Representative on the Bowers Landfill Community Information Committee

INRE: Bowers Landfill Superfund Site
Comments on the Remedial Investigation Report Dated 11-18-87
and Endangerment Assessment Draft Final Report

DATE: January 6, 1988

The tone of the discussion of the 1981 Burgess and Niple report strikes me as unusual. The discussion questions the validity of the findings in the Burgess and Niple report and discussed the deteriorated condition of the wells that were drilled in 1981. I have several reactions to that discussion. Burgess and Niple is known to me as a generally well respected engineering firm which Circleville City has used for their water testing. If it's that easy to question the results of a well respected firm in a study, how easy will it be to bring in question the results of the Dames and Moore report in 5 or 6 years? If all that is required is spending 3 or 4 times the money to do that, then we are looking at going through all this again in the 1990's at a cost of 1 or 2 million dollars to throw out much of what is found today. Being a generally respected firm, I also assume that Burgess and Niple took some kind of precautions that the wells they drilled were well constructed and secure to protect their reputation and our groundwater. The condition of those wells as described in the Dames and Moore report is appalling. Either their precautions were inadequate, or they were constructed in an irresponsible fashion. How do Dames and Moore's precautions compare in the construction of the new wells? How quickly will history repeat itself? Why should we not believe that elevated readings of organic vapors found in those wells represent a serious contamination problem? The water from those wells with the elevated readings was not tested.

Our other major observation about the Remedial Investigation is that well placement and groundwater flow have combined to perhaps miss major areas of contamination of the groundwater. Flow in the deeper aquifer was found to be close to straight south, but there are no sampling wells in the deeper aquifer south of the north-south leg of the landfill. This observation also has impact on the endangerment assessment in that the one route which will expose large numbers of people to a contaminant release is to the south where the city of Circleville has its well field 1½ miles from the landfill. This potential exposure is minimized in the endangerment assessment in spite of the fact that no sampling was done in that direction and flow rates are given that would place any contaminants as far as ½ to 2/3 of a mile south of the landfill.

We believe that background contamination of the Scioto River sediment probably is very bad as found in the Remedial Investigation report because of many years of pollution of the river by waste disposal practices within the city of Columbus. However, the samples done for background are close enough to the landfill that they could have been affected by run-off from the landfill during very heavy rains or flooding.

We offer the following criticisms of the Endangerment Assessment having already noted that we believe that insufficient weight is given to possible southward migration of contaminants in the groundwater to the Circleville well field in the deeper aquifer. Some of the "worst case scenarios" cited aren't really worst cases. For example, the report cites some studies of pica in children as the heaviest possible exposure by ingestion of soils, but having done some field cultivating myself, I would be reasonably sure that farming the land at the landfill could easily result in greater than 0.6 gm ingestion depending on wind speed and direction. The scenarios given also don't review the possibility of a concentrated exposure over time that might occur if a seepage would occur into the drainage ditch and a child spent some time wading, swimming in, and drinking from it. Given a sudden release of material during the frequent flooding cited, what would be the resulting exposure to areas also flooded downstream such as Circleville's well field?

The Endangerment Assessment does not address what changes might occur at the site due to graveling operations. These are occuring adjacent to the site and could cause changes in the groundwater movement if large quantities of gravel are removed.

1/6/88

The section of the report on cancer risks gives a "target range" of 10^{-4} to 10^{-7} as figures for risk of additional cancers. They try to hedge by saying that these are not intended to be "acceptable levels", but if clean-up is to these levels they will have to be accepted as the result of clean-up. As I understand these discussions, the "target range" of 10^{-4} is up to 100 times greater than that "generally accepted".

In summary, we find the following:

1. We find some difficulties with the Remedial Investigation if additional testing is not done to the south of the landfill in the deep aquifer.

2. We find that inadequate explanations are offered for discrepancies between present test results and earlier testing done at the site.

3. Background levels of sediment contamination may have been affected by contaminants from the landfill.

4. We find the "target range" for risk of cancer to be higher than we would consider acceptable.

We would respectfully request that consideration be given to additional deep wells near to the site and at a distance to confirm the hypothesis that contamination has not migrated in a southern direction toward the area of potentially greatest exposure to the nearby population.

We would also request that sampling continue before and during the Feasibility Study and any proposed clean-up to protect the surrounding area from any migrating contaminants not identified in the initial examination since it differs dramatically from earlier studies at the site.

Lastly, we request that in addition to the public question/answer meeting that there be a public written formal comment period of 90 days. We are aware that public written formal comments have been allowed at other sites. At Stringfellow in California the Feasibility Study began during the written comment period for the Remedial Investigation. The residents of Pickaway County will be most affected by and have to live with what results from the Remedial Investigation and should have the opportunity to submit their comments to be part of the formal record. It is too late to expect citizens to comment on the Remedial Investigation after the Feasibility Study. If citizens' comments are given serious consideration, then they should be welcomed when they are the most relevant at each phase of the Superfund process.

1/6/88

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Oh 43113 474-1240

TO: Erin Moran, Project Director, USEPA Region 5

FROM: Gary L. Gillen, M.D.
ACTION Representative on the Bowers Landfill Community Information Committee
William A. Myers, M.D., ACTION Alternate Representative

IN RE: Bowers Landfill Superfund Site
Comments on the Remedial Investigation Report Dated 4-28-88 and Endangerment Assessment Final Report

DATE: June 2, 1988

We continue to be overwhelmed by the process of evaluating and reviewing a Superfund site. Our present system relies on "adversaries" who argue opposing points of view. Each has the objective of "winning" their argument or obtaining a compromise that will come close to what they want to accomplish. Sometimes the objective is simply to prevent the "other side" from winning. An ideal system would find industry interested in identifying problems before they cause trouble and taking care of them before anyone gets hurt. A good system would have an impartial government agency that would identify a problem and see to it that those responsible for the problem did their best to take care of it. Instead, we have had a system in which industry has to avoid taking any responsibility for a problem so they are not put at an economic disadvantage or risk getting sued for admitting responsibility. The regulators have so far felt a responsibility in protecting the identified industries (potentially responsible parties) from unnecessary financial harm because of the unjustified fears of an "hysterical" public. So we have the ludicrous situation of citizens being forced to become experts in their local areas in order to adequately oversee the regulators overseeing the responsible parties. We ought to all be most interested in seeing that our various community problems are solved quickly and completely. We have many more interesting ways that we could spend this time than reviewing the 15 inches of documents so far generated or spending over 2 hours on the phone with various experts who donate their time for our benefit. There is no better way we could spend that time for the benefit of our community though.

We were gratified that additional wells were placed in the deep aquifer as we had suggested. We remain skeptical about the location and extent of sampling because of the apparent disparity in findings between the present study and earlier ones which had indicated heavier contamination than has been found in the present study. We remain unimpressed with the argument that previous studies' results should somehow be ignored because of possible inadequate quality control. The compounds (mixed xylenes, toluene, ethylbenzene) that were found in those studies in significant amounts are not ones that would likely be due to lab error or external contamination. The previous results would seriously change the results of the Endangerment Assessment. Our consultants also reviewed the data used to determine the direction of groundwater flow. The data are not totally convincing that the flow is definitely to the west. The water levels and wells are close enough to each other to make it difficult to say. The additional work plan stated there would be three additional wells drilled into the deep aquifer. Only two were done with no explanation. As we have previously suggested, wells further from the site could be helpful in that regard.

Chapter 5 of the Remedial Investigation (RI) notes that tetrachloroethene might be related to activities at the sand and gravel quarrying operation adjacent to the landfill. Since it is a solvent

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Oh 43113 474-1240

generally used in dry cleaning clothing and industrial applications, we doubt that it would likely occur about sand and gravel quarrying unless they were experimenting with dry cleaning the gravel. Such comments and logic cause one to pause and ponder the real motive of those doing the evaluating.

We note that this draft of the report states that extensive sand and gravel quarrying does occur about the site. The report also speculates that those exposed areas of high water permeability may aid in creating part of the hydraulic pressure moving the groundwater to the west. The report does not speculate what will happen to groundwater flow and the contaminants the water contains should those quarrying operations reach below the water table as they have at locations south of the site.

The RI states in Chapter 2 that the threat to the Circleville well fields is probably very slight because the sand and gravel at the site is very permeable and relatively unconfined, yet we are told that the Scioto River acts as a barrier to westward migration of contaminants because the groundwater discharges uphill into the river from the groundwater 20-60 feet down. That sounds far-fetched.

The report continues to document very well that the landfill is flooded frequently and further that the "clay layer" under the landfill might slow movement into the groundwater, but we still have very little comment about how that flooding might distribute contaminants and contaminated soil from the landfill. The Endangerment Assessment also gives little space to that question - even though, whatever is done to the site, it is safe to say that it will continue to be flooded very frequently after some remedy is performed on the site.

We found it very interesting that the Endangerment Assessment made a table of proposed scenarios of impact of our site of present and future dangers. Of the 10 scenarios sited, 7 were cited as possible dangers to "recreational users" of the site. The RI documented use of the site by fishermen and users of all-terrain vehicles. We have stated on numerous occasions since 1984 that the landfill should have a fence around it. A simple fence around 12 acres in 1984 would have reduced all of those exposures and future exposures to only those who were intent on being exposed at far less cost than a small fraction of what this study has cost so far. Now we have a study that we still have trouble with, and all those exposures are still continuing. We propose that the single most cost-effective procedure that could have been done to reduce past and future exposures to contaminants in the landfill would be to limit recreational use of the area by means of a fence.

We will continue to request that provisions be made to test nearby water wells, including those for the city of Circleville, on a regular basis for appropriate contaminants and that said testing should occur quarterly. We also understand that at other Superfund sites requirements of safe "clean-up" have been defined at the point of exposure. We will have great difficulty with any plan which proposes to achieve "relevant and appropriate requirements" by a mathematical formula at the Circleville well fields or nearby wells.

In summary, we find the RI and Endangerment Assessment flawed, inadequate and unacceptable by the continued attempts to make the results fit what the regulators and responsible parties want to do or not do to the site, by an attempt to minimize major problems thwarting clean-up at the site because they don't know what to do about it, by an attempt to minimize hazards to avoid frightening local residents, and by an attempt to minimize

6/2/88

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Oh 43113 474-1240

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problems to avoid putting too much economic stress on the responsible parties. We have many of these same concerns, but attempting to tiptoe around these areas will only reduce our ability to solve the problems at the site to the best of our abilities. That could hurt our community, our industries, and our legacy to future generations.

These written remarks are to be published with the Final Remedial Investigation report as agreed upon by Ms. Jennifer Hall, USEPA Region 5.

cc: Valdus Adamkus, USEPA Region 5
Richard Shank, OEPA Director
Governor Richard Celeste
Senator Frank R. Lautenberg
Attorney General Anthony Celebrezze, Jr.
Pickaway County Commissioners
Stephen Lester, CCHW
Rep. Mike Dewine
Senator Jan Long
Rep. Mike Shoemaker
Mayor Mike Logan
Senator John Glenn
Senator Howard Metzenbaum

6/2/88

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Oh 43113 474-1240

PRESS RELEASE - Bowers Landfill Superfund Site Public Meeting
Wednesday, Sept. 14, 1988, 7 p.m., Circleville High School Cafeteria
Contact: ACTION, 474-1240; Spokespersons: Paul Turner, 983-2172 and Gary L. Gillen, M.D., 474-2126 or 474-8818 or 474-5303

We find the Remedial Investigation (RI) and Endangerment Assessment flawed, inadequate, and unacceptable by the continued attempts to make the results fit what the regulators and responsible parties want to do or not do to the site, by an attempt to minimize major problems thwarting clean-up at the site because they don't know what to do about it, by an attempt to minimize hazards to avoid frightening local residents, and by an attempt to minimize problems to avoid putting too much economic stress on the responsible parties. The following are examples of the flawed logic contained in the two reports:

1. We remain unimpressed with the argument that previous studies' results (OEPA in 1980 and Burgess & Niple in 1981) should somehow be ignored because of possible inadequate quality control. The compounds (mixed xylenes, toluene, ethylbenzene) that were found in those studies in significant amounts are not ones that would likely be due to lab error or external contamination.

2. Since tetrachloroethene is a solvent used in dry cleaning clothing and industrial applications, we doubt that it would occur in the adjacent sand and gravel quarrying as Chapter 5 of the RI states unless they were experimenting with dry cleaning the gravel.

3. The reports do not speculate what will happen to groundwater flow and the contaminants the water contains should adjacent quarrying operations reach below the water table as they have south of the site.

4. The data are not totally convincing that the groundwater flow is definitely to the west since water levels and wells are close enough to each other to make it difficult to say. As we have previously suggested, wells further from the site could be helpful in that regard.

5. In Chapter 2 of the RI we are told that the Scioto River acts as a barrier to westward migration of contaminants because the groundwater discharges uphill into the river from the groundwater 20-60 feet down. That sounds far-fetched.

6. Both reports document very well that the landfill floods frequently but neither addresses how that flooding might distribute contaminants and contaminated soil from the landfill.

7. Of the 10 present and future dangers sited, 7 were sited as possible dangers to "recreational users" of the site (fishermen and all-terrain vehicles). We have stated on numerous occasions since 1984 that the landfill should have a fence around it for this reason. The single most cost-effective procedure that could have been done to reduce past and future exposures to contaminants in the landfill would be to limit recreational use of the area by means of a fence. A costly inadequate study was certainly not necessary to determine this.

In conclusion, such comments and "logic" cause us to pause and ponder the real motives of those doing the evaluating. It appears we have a system in which the regulators feel a responsibility to protect the responsible parties from the unjustified fears of an "hysterical" public. So we have the ludicrous situation of citizens being forced to become experts in their local areas in order to adequately oversee the regulators overseeing the responsible parties. To tiptoe around obvious areas of concern will only reduce our ability to solve the problems at the site to the best of our abilities. That could hurt our community, our industries, and our legacy to future generations.

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113 474-1340

TO: Erin Moran, Project Director, USEPA Region 5

FROM: Gary L. Gillen, M.D.
ACTION Representative on the Bowers Landfill
Community Information Committee

IN RE: Bowers Landfill Superfund Site
Comments on the Feasibility Study, Second Draft Report
Dated August 19, 1988

DATE: November 2, 1988

Our comments on the second draft of the Feasibility Study should not be taken to imply that we have accepted the findings of the Remedial Investigation and Endangerment Assessment. We continue to find those reports seriously flawed in two main areas. First, the findings are significantly different from work done earlier at the site by Burgess & Niple and by Ohio EPA without any adequate explanation. I can suggest two possibilities that are at least as good as those given. There may have been significant leaching of contaminants into the groundwater at the time of the earlier studies which was quiet at the time of the present study due to local hydrogeologic factors related to the recent two year drought conditions, or the earlier findings might have been related to a migrating plume of contaminants that has now moved off-site. Secondly, one cannot determine that groundwater flow from the site is only to the west without additional studies off-site to determine whether groundwater flow on the west bank of the Scioto River might be coming east to combine with material from the site and then follow the river flow to the south toward the city well fields. Attached to my statement is a letter from Mark Scarpitti of our District Soil and Water Conservation Office confirming that others with training in soil and water agree that these are valid concerns not addressed in the Remedial Investigation. Specifically, Stanley Norris' report on the groundwater situation in the Circleville area (6) verifies that a southerly flow could occur in this area.

In regard to the Feasibility Study, Second Draft, presented to us, it appears that once again, as has happened frequently across the country, the contractor and the EPA are choosing a "containment" method for our site even though the law as revised in 1984 now requires the EPA to prefer permanent remedies for sites. A recent report by traditional environmental groups and the Hazardous Waste Treatment Council (1) examined 75 records of decision (ROD's) produced by EPA in 1987 and found that full waste treatment was recommended in only 6 cases, partial treatment was recommended in 18, and no treatment at all was recommended in 51 cases or 68% of the sites. They recommended a clay or asphalt cap for some, a slurry wall to contain some, or excavating the wastes and reburying them in another landfill creating a toxic merry-go-round for others. We find that the present document defines containment with even less structure (i.e., to "maintain the cover" and use rocks to "stabilize" the landfill from washing away from frequent flooding). The traditional clay cap or plastic cover are dispensed with as not "cost effective". This is interesting, because under SARA, cost effective received a new definition. Cost effective is defined now as that "in determining the appropriate level of cleanup, the President (through his agency, the EPA) first determines the appropriate level of environmental protection to be achieved and then selects a cost effective means of achieving that good". If containment is the appropriate level of protection determined for our site, and flooding is the major external source of water washing out the landfill, then the minimum containment method would have to protect the site from flooding. Only the proposed flood dike would do that of the methods examined which was eliminated because it was not cost effective for our site.

In their review of 100 Superfund sites, the Office of Technology Assessment published a summary report in June, 1988, (5) which was critical of EPA's frequent use of unproven technologies. The proposal to maintain the present cover on the landfill as a containment method is one such unproven technology. I must admit some discomfort in bringing up the point because the only other proposals for cover involve a clay cap or a plastic cap. Both of those have been proven to fail to permanently contain at sites where they have been used. I described this Feasibility Study proposal to Dr. Peter Montague, an expert in hazardous waste sites all over the country. He believes this sounds like a variation of several proposals happening at some sites which has been described as "natural flushing". He thought this proposal is the equivalent of doing nothing while waiting for rainfall and floods to flush the contaminants into the surface and groundwater. So, the proposal is not even a containment method, but a treatment method apparently designed to reduce some contaminants at the site by washing them away to parts unknown. In a 1961 study (7), the U.S. Public Health Service is critical of the concept that diluting groundwater will reduce concentrations. They note that often chemicals will migrate in groundwater without changing concentration as can happen in surface water. Some can even concentrate under certain circumstances. The cost estimates also do not take into account the potential for astronomical increases when these impermanent remedies eventually fail (5).

The proposal for monitoring wells is inadequate with no provision for wells further off-site and with no provision for determining when, where, and how any action might occur as a result of the monitoring or who might be responsible for the costs of further action at the site when a failure is documented. Further, there is no definition of what levels of which chemicals might be identified as a reason for further action. Will we go through more studies to determine a next step? The EPA has previously accepted such proposals for monitoring a site to detect a "failure" without defining what a failure is (5). We should not repeat that mistake.

We are pleased to see a proposal for site restriction which includes a fence as we have recommended since 1984. I suspect it will be at least 1990 before that fence exists at the site. That is unfortunate, especially for those who unknowingly wander on-site.

In the past, EPA has pushed most records of decision to meet their annual report deadlines which has led to poor cleanup decisions (5). We do not want to be another poor decision statistic. If this Feasibility Study is approved without changes, we request that the 30 day public review and comment period occur after the busy holiday season (after the first of the year). We expect our written comments to be published with the final Feasibility Study as they were with the Remedial Invrstigation.

11/2/88

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113 474-1240

cc: Valdus Adamkus, USEPA Region 5
Richard Shank, OEPA Director
Governor Richard Celeste
Senator Frank Lautenberg
Attorney General Anthony Celebrezze, Jr.
Pickaway County Commissioners
Stephen Lester, CCHW
Lee Thomas, USEPA
Senator Howard Metzenbaum
Rep. Mike Dewine
Senator Jan Long
Rep. Mike Shoemaker
Mayor Mike Logan
Senator John Glenn
Peter Montague
Joel Hirschorn, OTA
John Adkins
Mark Scarpitti

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(4) "Hazardous Waste News #98", October 10, 1988, Environmental Research Foundation, Princeton, New Jersey.

(5) Are We Cleaning Up? 10 Superfund Case Studies, Office of Technology Assessment, Congress of the United States, June, 1988.

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(10) Personal Communication, Peter Montague, Ph.D., Environmental Research Foundation, Princeton, New Jersey, October, 1988.

(11) Personal Communication, Mark A. Scarpitti, District Conservationist, United States Department of Agriculture, Soil Conservation Service, Circleville, Ohio, October, 1988.

11/2/88

United States
Department of
Agriculture

Soil
Conservation
Service

Dr. Gary Gillen
Action Rep. Bowers Landfill
111 Island Road
Circleville, Ohio, 43113

October 25, 1988

Dear Dr. Gillen,

I attended the Ohio EPA Remedial Investigation public information meeting of the Bowers landfill on Sept. 14, 1988.

At that meeting the engineer representing EPA stated that according to their study, the ground water in the vicinity of the landfill on the east side of the Scioto River flowed from east to west or toward the river. It was emphasized that groundwater generally flows downhill. The conclusion was drawn that any possible seepage from the Bowers landfill would also flow toward the river and would therefore pose no threat of contamination to municipal water supplies. The municipal wells are located approximately 1.5 miles south (downstream) of the landfill adjacent to the Scioto River.

When I ask him if it was logical to assume that groundwater west of the Scioto River flowed east toward the river, he stated it was possible but that no study of groundwater movement had been conducted west of the river.

I asked him further if groundwater on each side of the river were in fact moving from the uplands to the river (downhill) wouldn't it be likely that the water would meet at the river and turn south or downstream. He stated that it was possible but the groundwater movement was not studied to that degree.

Since that meeting I have tried to research the assertion that the groundwater in the Circleville area does move from the uplands to the floodplain toward the Scioto River. And that as it approaches the river it turns in a southerly direction with the flow of the river.

I have been in contact with the Ohio Department of Natural Resources, Division of Water, Section of Ground Water. They indicated that it is common for the ground water to generally follow surface water unless restricted by some impervious layer. And that it is likely that the ground water does move toward the river. They indicated it is also likely that some of the ground water surfaces at the river while the other portion remains in the gravel aquifer under the riverbed and moves parallel with the river.

They referred me to several publications concerning the ground water flow in the Scioto River basin. One such study from the Ohio Department of Natural Resources, Division of Geological Survey is Report of Investigations No. 96. "The Ground-Water Situation in the Circleville Area, Pickaway County, South-Central Ohio". This report was written in 1975 by Stanley E. Norris, Hydrologist as a result of a study conducted of the ground water supply in the Circleville area. In this report Mr. Norris speaks of the principal source of recharge into the aquifer in the area of Circleville;

> "The principal source of recharge to the aquifer supplying the industrial wells is precipitation. Some precipitation enters the aquifer within the area underlain by the cone of depression, but most enters upgradient from the cone and flows into it in response to the regional gradient. Generally the potentiometric surface in the Circleville area is higher in upland areas. Consequently, ground water moves from the uplands toward the Scioto River valley. This component of recharge, moving in response to the regional gradient, is referred to here as underflow.
>
> Where the sand and gravel deposits are separated by a semiconfining bed, water from precipitation reaches the wells after moving downward through the semiconfining bed. Or, water may enter the lower aquifer directly in areas where the semiconfining bed is absent and move laterally beneath the semiconfining bed. Water also enters the aquifer from the Scioto River by influent seepage where the water table is below the stream..."

After talking with the Division of Water and studying the reports available, I believe the safe assumption is that hazardous chemical waste from the Bowers landfill does have the potential of contaminating downstream water supplies and any landfill clean-up efforts should consider this potential.

I am a little surprised and disappointed that the investigations conducted by EPA did not study ground water flow surrounding the landfill as well as in the immediate area of the landfill.

If you have any questions please let me know.

Sincerely,

Mark

Mark A. Scarpitti
District Conservationist

10/25/88

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113 474-1240

TO: Erin Moran, Project Director, USEPA Region 5

FROM: Gary L. Gillen, M.D.
ACTION Representative on the Bowers Landfill
Community Information Committee

IN RE: Bowers Landfill Superfund Site
Comments on the Feasibility Study, Third Draft Report
Dated February 3, 1989

DATE: February 28, 1989

Most of the comments of our letter of November 2, 1988, (attached) still apply to this third draft of the Feasibility Study. I was pleased to see much better discussion of treatment options. I remain disappointed that some alternative to containment has not been identified for our site. There is better discussion of how groundwater monitoring might be done. There is still not sufficient clarification as to what will happen and who will be responsible when various contaminants are identified. I will expect these details in the Record of Decision but I would have appreciated the opportunity to comment on them in the Feasibility Study. We still believe that some monitoring wells need to be installed off-site in the direction of Circleville City's water wells. According to our local Soil and Water Conservation representative (statement attached), one cannot determine that groundwater flow from the site is only to the west without additional studies off-site to determine whether groundwater flow on the west bank of the Scioto River is coming east to combine with material from the site and then follow the river flow to the south toward the city well fields. A fence remains a protection factor which has yet to be constructed.

The discussion of the alternatives which mention a clay cap correctly observes that the cap would provide some protection from flooding by covering the landfill to prevent flood waters from eroding away the surface and that flood waters will infiltrate less if a cap is in place. There is no discussion, however, regarding maintenance of the clay cap through repeated flood events which occur at our site. I believe that the costs of maintaining a cap and ground cover through repeated flooding could make a flood control dike look much more cost effective. A flood control dike will also require maintenance but not the kinds of extensive repairs that the clay cap will require when it is overrun completely every 5 years (as reported in this study) and at least partially overrun every year. It should be kept in mind that all of the testing data and observations in this report were made early and in the middle of the worst drought to affect this area in the past 60 years.

The study continues to speculate about the possibility of "maintaining the present cover" as a containment strategy. I agree that it is an idea worthy of speculation given the known problems of clay caps and synthetic membrane caps, but our site is not a proper one for such speculation with contaminants poorly identified as to location and concentration. We agree that there is no reason to choose between a clay cap and a synthetic membrane cap. They are both prone to deterioration and entirely dependent upon expert installation and maintenance. Both can leak without obvious appearance, and both will leak eventually.

A cap alone will not adequately protect our site from erosion and infiltration of water during frequent floods. A flood control dike would be an important safeguard to the integrity of the remedial action.

We conclude that the Remedial Investigation, Endangerment Assessment, and Feasibility Study are flawed, inadequate, and unacceptable. They make repeated attempts to make the results fit what the regulators and responsible parties (PPG & Dupont) want to do or not do to the site. They attempt to minimize major problems thwarting clean-up at the site because the contractors and the agencies don't know what to do about it. They attempt to minimize hazards to avoid frightening local residents and to minimize problems to avoid putting too much economic stress on the responsible parties. We believe that any containment plan is doomed to fail and that such plans must be reinforced to the maximum and monitored carefully to discover the failure when it occurs and should specify who will be financially responsible when the failure occurs. We believe the responsible parties should bear the costs of containment failure and maintenance and in correcting any contamination problems.

cc: William Reilly, USEPA
Valdus Adamkus, USEPA Region 5
Governor Richard Celeste
Senator Frank Lautenberg
Attorney General Anthony Celebrezze, Jr.
Pickaway County Commissioners
Stephen Lester, CCHW
Senator Howard Metzenbaum
Rep. Mike Dewine
Senator Jan Long
Rep. Mike Shoemaker
Mayor Mike Logan
Senator John Glenn
Peter Montague
Joel Hirschhorn, OTA
John Adkins
Mark Scarpitti

2/28/89

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113   1-614-474-1340

MEMO TO: USEPA Region 5

FROM: Cynthia Gillen, ACTION

IN RE: Bowers Landfill Remedial Investigation & Feasibility Study

DATE: February 28, 1989

I have several concerns about what is being proposed for Bowers Landfill and the Superfund process that has transpired.

The Bowers Landfill was included as one of 19 Ohio sites on the National Priority List for Superfund cleanup in 1982. Among those sites, it had a Hazard Ranking Score or potential to cause harm of 3rd within the state. The highest hazard score was for potential groundwater contamination. In 1980, OEPA identified toluene, benzene, and ethylbenzene in leachate from Bowers Landfill. In 1981, Burgess & Niple found high concentrations of ethylbenzene, toluene, and mixed xylenes in downgradient wells.

The present study has significantly different findings from previous testing and attempts to ignore previous findings or speculate about problems with laboratory quality control and possible lab contamination of samples. This logic is flawed for several reasons. The labs doing the previous testing were both OEPA approved chemical laboratories. Burgess & Niple's work was also coordinated and approved by USEPA Region V. The kinds and amounts of contaminants found in the samples are not likely to have occurred from laboratory processing and handling. There are at least two more logical reasons which are given no consideration. There may have been significant leaching of contaminants into the groundwater at the time of the earlier studies which was quiet at the time of the present study due to local hydrogeologic factors related to the recent two year drought conditions, or the earlier findings might have been related to a migrating plume of contaminants that has now moved off-site. Will EPA be able to so easily discredit the present results also done by EPA approved companies if contamination problems occur in the future?

When the Bowers Landfill was listed on the National Priority List in December, 1982, the conditions at listing by USEPA stated the landfill covered 80 acres (attached). No explanation is given for why this site has dwindled to only 12 acres. In the same USEPA statement, it states that in excess of 7500 tons of chemical wastes were disposed of at the site. Now the present study states that the exact amount of hazardous waste placed in the landfill is unknown, and speculates that it was probably a small percentage of the total disposed material. Even if this is true - and USEPA themselves state they don't know for sure - many hazardous chemicals of the kinds dumped at Bowers have the potential to cause harm to human health and the environment in very small amounts (i.e., parts per billion or million). Flawed logic again. The present report also states that the amount of hazardous waste remaining there is unknown.

The RI has failed to locate and identify contaminants and is proposing containment while at the same time acknowledging that the location and quantity of wastes are unknown. How can one contain something without knowing the location and quantity to be contained? It sounds like a stab in the dark to me. According to an Office of Technology Assessment report of June, 1988, which assessed the Superfund Implementation, one criticism is that, "It is not uncommon to have a multimillion-dollar cleanup decision made without any technical data to support it.."

The Endangerment Assessment is not relevant because of the failure of the RI to identify and locate contaminants. It uses a cancer risk factor of 1 in 10,000. Another OTA criticism states that "Sometimes compromises are made to reduce cleanup cost by allowing a higher risk than the 1 in 1 million cancer risk commonly used in Superfund." With this study, USEPA has compromised our risk and allowed up to a 100 times greater risk than that generally accepted. Why? Again, OTA states that environmental risks seem to take a back seat to constraints imposed by seeking funds from responsible parties.

USEPA and OEPA have chosen to ignore a statement submitted by ACTION at the Community Information Committee meeting on November 2 from our District Soil and Water Conservation representative which presents valid conflicting evidence about groundwater flow. It is based upon his discussions with the Division of Water and a study done in 1975 by Stanley Norris for ODNR, Division of Geologic Survey (#96) about the groundwater situation in the Circleville area, Pickaway County. In the RI, it is determined that groundwater flow under the site is to the west downhill and toward the river. However, the geologic and groundwater conditions on the west side of the river could also be downhill and toward the river since according to Mr. Norris, ..."groundwater moves from the uplands toward the Scioto River valley" and moves in response to the regional gradient. In conclusion, groundwater on the west side of the river could be moving east and downhill to combine with the westerly flow from the east and follow the river toward the south. This would dramatically change the Endangerment Assessment and the potential for contamination of Circleville's well field, 1 1/2 miles south and downstream. The study done for ODNR was much more extensive than the present Remedial Investigation which relied only on conditions in the immediate area of the site.

Our request to do further studies off-site to better determine groundwater flow in lieu of this evidence has been ignored. Thus far, our request for monitoring wells off-site between the landfill and the city's wells has also been ignored. What is the substantiated reason for ignoring this evidence and for not placing these wells?

For the protection of our community and people who live near the landfill, I believe that groundwater monitoring should be done indefinitely on a quarterly basis for priority pollutants and heavy metals as long as there is any question as to the exact location, amounts and kinds of contaminants emanating from the site. There must be provisions for monitoring all potential contaminants emanating from the site and not just the few identified in the RI. This testing should be done on the residential wells near the landfill, Circleville City water wells, and monitoring wells off-site between the landfill and the City water wells in addition to those included in the FS. I don't understand why there is a reduction in monitoring after the first year. How can EPA assume there will be a sudden reduction in risk after the first year with all the unknowns in the RI? It would appear they are relying on public disinterest with time.

The FS states that alternative 4 would comply with current State of Ohio closure standards for solid waste landfills. Since hazardous waste was dumped at Bowers, I would like to know if any of the alternatives comply with current State of Ohio closure standards for hazardous waste facilities. If not, why not?

It would appear that USEPA has conducted a useless study that has no conclusive data. Could this be because the regulators and the responsible parties want to avoid finding contaminants in order to fit what they don't want to do at the site and to avoid putting too much economic stress on the responsible parties? There is something wrong with a system that allows the responsible parties to be directly responsible for the writing of the FS along with the contractors. Any other system would claim this as an obvious conflict of interest.

To further add to this flawed logic, a containment system is being proposed to contain unknown wastes in an unknown amount and unknown location. According to OTA, there is substantial evidence that containment techniques are unproven and unreliable technologies with significant implementation problems. An example is the RCRA clay cap at the Winthrop Landfill site in Maine which failed in September, 1987, before its construction was completed. The OTA also states "impermanent remedies, which provide less protection than permanent ones and do not assuredly meet cleanup goals, are often selected purely because they are cheaper in the short run; in the long run they are very likely to be more expensive." There are various treatment technologies available which could offer a permanent remedy but which do rely on specific identification and location of contaminants. Because of USEPA's inadequate study which failed to do either, permanent remedies which are more expensive in the short-term are not a consideration in the FS. The impermanent remedy proposed for our site is generously estimated to have a life of 30 years. The maintenance and monitoring costs of this remedy which is doomed to fail, have been grossly underestimated. No provision is made as to who will be responsible for such costs including any further cleanup. For that matter, it is not clear who is paying for the proposed remediation. We believe the responsible parties should be financially responsible for any present and future costs - not our state or county or community - and strongly object to any condition in the ROD that would remove that responsibility and liability from them.

OTA also states that "EPA is less responsive to community concerns about a remedy being impermanent than to interests which favor a lower cost impermanent remedy." The incentives for this are to keep the costs low for the responsible parties and the state that has to provide 10% of the cost if the responsible parties don't pay and because EPA wants to distribute available funds as broadly as possible and wants to obtain settlements with responsible parties to reduce calls on Superfund money.

According to OTA, "EPA pushes most ROD's to completion by the end of the fiscal year and this kind of bureaucratic pressure can lead to poor cleanup decisions. Typically, there is less than one month between the end of the public comment period and the issuance of the ROD." I was told by Ms. Nelms that the USEPA wants to make a ROD before the end of March for its quarterly report. It's evident that USEPA does not give public comment much consideration because of the time allotted - 30 days to review and comment on documents that have taken USEPA three years to study and approve. Ironically, even though EPA is familiar with the work and documents, they have rarely taken less than 90 days to review and revise them themselves during the RI/FS. Evidently, I can only assume that EPA is just going through the motions of "acting" like they want our opinion and will give it consideraion.

During this three year process, the only continuity has come from our community. We now have our 4th USEPA community relations coordinator, and the OEPA personnel assigned to our site have also changed at least twice. From the beginning, our Remedial Project Manager, Erin Moran, has not instilled us with the utmost confidence in the USEPA as an agency. At one point in the beginning of the process, we requested a different project director but were assured by Ms.

Margaret McCue, our community relations coordinator at the time, that Ms. Moran was qualified even though she appears hesitant and unsure to respond to specific questions about our site at public meetings. At most meetings, she's appeared indifferent and somewhat sure only when she reads prepared statements. I, therefore, request that the Community Information Committee remain in existence during any remedial action and monitoring to facilitate communication with the community on a regular basis.

In conclusion, I do not believe what USEPA calls a "cleanup remedy" gives overall protection of public health and the environment. USEPA has allowed too many points to be vague and unclear in this FS which we would have appreciated the opportunity to comment on and which are evidently going to be decided by EPA in the ROD. I must agree with Senator Frank Lautenberg, head of the Senate Environment and Public Works subcommittee on Superfund and the environment, that the EPA "instead of acting as a watchdog for industry is acting as their lap dog." The 1988 OTA study verifies that "The Superfund toxic waste dump cleanup program is ineffective, inefficient, and uses pennywise, pound-foolish methods that may have to be reworked at great expense." Bowers Landfill is evidently just another statistic for another OTA study about the ineffectiveness of the Superfund program.

cc: William Reilly, USEPA
Valdus Adamkus, USEPA Region 5
Governor Richard Celeste
Senator Frank Lautenberg
Attorney General Anthony Celebrezze, Jr.
Pickaway County Commissioners
Stephen Lester, CCHW
Senator Howard Metzenbaum
Rep. Mike Dewine
Senator Jan Long
Rep. Mike Shoemaker
Mayor Mike Logan
Senator John Glenn
Peter Montague
Joel Hirschhorn, OTA
John Adkins
Mark Scarpitti

National Priorities List Site

Hazardous waste site listed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) ("Superfund")

BOWERS LANDFILL
Circleville, Ohio

Conditions at listing (December 1982): Bowers Landfill, also known as Island Road Landfill, covers 60 acres about 1 mile north of Circleville, Ohio, within the Scioto River floodplain. The site is situated over a very productive aquifer (capable of yields of 1,000 gallons per minute) that supplies both industrial and domestic water. In 1958, a gravel pit started operations on the site. Shortly thereafter, a landfilling operation started in which soil from the nearby pit was used to cover refuse dumped on top of the existing surface. Little is known of the initial years of the landfill, but from 1963 to 1968, it accepted organic and inorganic chemicals and general domestic and industrial refuse. In response to a Congressional inquiry, two local chemical manufacturers stated that in excess of 7,500 tons of chemical waste (physical state and concentrations unknown) had been disposed of at this site. In July 1980, EPA identified toluene and ethylbenzene in water from the landfill. The State worked with the current owner, who hired an engineering firm to evaluate the site. The State reviewed the report and asked for additional information.

Status (July 1983): The State reviewed the additional information from the owner and is awaiting the final Remedial Action Master Plan EPA is preparing. It will outline the investigations needed to determine the full extent of cleanup required at the site.

EPA ID - OHD 980509616
Contact - Erin Morgan
Population 11,700
CD - 7
HRS - 50.49

RAMP Development - complete - EPA lead - $39,000
Spent 2/1/83 - 713,1??
RI/FS - EPA lead - $400,000 allocated - No action yet

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113 1-614-474-1240

MEMO TO: Valdus Adamkus, Director
USEPA Region 5

FROM: Representatives of ACTION

IN RE: Community Information Committee

DATE: February 23, 1989

We have been told by Ms. Barbara Barnett that the continuation of the Bowers Landfill Community Information Committee during the remedial action and ongoing maintenance under the Record of Decision is under consideration. We have also been told that USEPA has considered our committee to be a valuable asset for communication with the community during the Superfund process.

We, therefore, respectfully request that the Bowers Landfill Community Information Committee be continued so that we, the community, may be appriced of all work and developments at the site. The Committee should not be disbanded until a mutually agreed upon date is decided by the Committee that it is no longer needed for community communication.

Beverly Bower
Nancy Cook
Nancy Shallenberger
Cynthia Gillen
Carol Robertson
Debra K. Hurd
Patricia A. Mullins
Arthur L. Robertson
Bruce Robertson
Marcella A. Ramey
Elizabeth Turner
Paul W. Turner
Patricia A. Payne
Carol J. Moore
Ralph E. Dunkel

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113 1-614-474-1240

MEMO TO: Valdus Adamkus, Director
USEPA Region 5

FROM: Representatives of ACTION

IN RE: Community Information Committee

DATE: February 28, 1989

We have been told by Ms. Barbara Barnett that the continuation of the Bowers Landfill Community Information Committee during the remedial action and ongoing maintenance under the Record of Decision is under consideration. We have also been told that USEPA has considered our committee to be a valuable asset for communication with the community during the Superfund process.

We, therefore, respectfully request that the Bowers Landfill Community Information Committee be continued so that we, the community, may be apprised of all work and developments at the site. The Committee should not be disbanded until a mutually agreed upon date is decided by the Committee that it is no longer needed for community communication.

Albert J Rose
Ann M Harr
Kim Ritter
John Payne
Bob Bowenchause
Robert Hite
Freda Hite
Virginia Lewis

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113 1-614-474-1240

MEMO TO: Valdus Adamkus, Director
USEPA Region 5

FROM: Representatives of ACTION

IN RE: Community Information Committee

DATE: February 28, 1989

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J. L. Chilcote
Jeannette M. Chilcote

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113 1-614-474-1240

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USEPA Region 5

C: WMD
CC: ORA
FREEMAN
OPA -

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RECEIVED
MAR 06 1989
U. S. EPA REGION 5
OFFICE OF REGIONAL ADMINISTRATOR

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113

I am submitting the additional following comments for the public comment period of the Bowers Landfill Superfund Site.

What is happening to the Bowers Landfill Superfund site? The USEPA and the potentially responsible parties, PPG and DuPont, have just completed a study that cost approximately $700,000 and are unable to give us anymore conclusive information about the site. Volumes of data have been generated and a containment remedy proposed which still ignore potential threats presented by this hazardous waste site. The USEPA has stated that a final cleanup decision will likely be made by March 31.

1. GROUNDWATER FLOW. According to the EPA study, groundwater flow under the site is determined to be to the west toward the Scioto River and, therefore, the Circleville municipal well field located 1.5 miles south is not expected to be affected by potential groundwater contamination.

The District Soil and Water representative, Mark Scarpitti, has presented information from a Department of Natural Resources study which presents valid conflicting evidence about groundwater flow off-site. Since the groundwater moves from the uplands to the Scioto River valley, it is probably combining at the river and flowing south toward the wells and to fill in the depression created by the heavy industrial pumping in the Circleville area. The USEPA did not study groundwater flow outside the immediate area of the site and could be making a serious inaccurate assumption about potential risks to our water supply. They have ignored and have not refuted this evidence and have no plans to install monitoring wells between the site and the city wells.

2. LOCATION OF WASTES. Previous testing at the site showed high levels of contaminants in leachate and groundwater in 1980 and 1981. Present test results generally show low levels of contaminants. The EPA study states that about 40% of the waste was generated by various industries operating in the area, including PPG and DuPont, among others. Responses by PPG and Dupont to a federal survey in 1978 indicate they dumped 1700 and 6000 tons of material respectively. Other local industries evidently did not respond to the survey.

USEPA has not drilled into the site or installed monitoring wells outside the site to determine the location of wastes but is proposing a remedy to contain something. One major area ignored by this study is that this site floods frequently which has presented great potential for contaminant migration since its closure in 1968. In a 1985 meeting with local citizens, Mr. Roger Hannahs of OEPA acknowledged this concern and promised that "OEPA will require testing further out from the site until contaminants are located if not located at the initial test sites." Where is Mr. Hannahs now?

3. METHANE GAS. The EPA study negates any threat from methane gas and the need for any gas venting system since this site has been closed for 20 years. However, specific air tests for methane gas were not performed at the site.

According to an Army Corp of Engineers report (January, 1984), landfill sites can give off methane gas for 50 years or more after closure, especially sites constructed prior to 1970, like Bowers, that had no gas venting systems. The proposed containment with no gas venting could cause methane gas to migrate laterally, carry contaminants to nearby homes and present a public health emergency. An example in our own state is the Industrial Excess Landfill site in Uniontown where methane gas was found to be migrating laterally and under nearby homes.

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113

4. THE SUPERFUND LAW AND CLEANUP STANDARDS. USEPA and OEPA have interpreted the Superfund cleanup standards for Bowers to mean meeting "current Ohio solid waste landfill closure standards". However, solid waste closure laws are not relevant and appropriate for hazardous waste sites.

The Superfund law states that the remedy must comply with any state environmental or facility law that is not less stringent than any federal law for the hazardous substance or release in question. Solid waste closure laws are not relevant and appropriate for hazardous waste sites. This site should not set a precedent for other hazardous waste sites, such as the Barthelmas Landfill, to be treated like solid waste sites.

USEPA and OEPA are using solid waste laws because they are relevant and appropriate for what they want to do to the site. Using solid waste laws for a hazardous waste site is not in compliance with the Superfund law requirement that a first criteria should be the overall protection of the public health and the environment.

In summary, a final cleanup decision cannot rely on a study that makes major assumptions based on speculation or such limited data. USEPA states their remedy addresses a worst case senario situation. A worst case scenario situation would not ignore major conflicting evidence or unanswered areas of concern. It is not surprising that such little or poor oversight of the work at Bowers occurred with the constant turnover of personnel at both USEPA and OEPA. Our community offered a major need for continuity to this process. However, if USEPA had been receptive to our community's suggestions during this study, we could have had a more credible study and be confidant about moving forward to resolve the potential problems presented by Bowers.

For A Cleaner Environment,

Cynthia Gillen

Cynthia Gillen, March 10, 1989

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113 1-614-474-1240

PRESS RELEASE - BOWERS LANDFILL SUPERFUND SITE - PROPOSED "CLEANUP"

We believe the only conscientious approach to the potential problems presented by our neighborhood Superfund site, the Bowers Landfill, should be as follows:

First and foremost, a fence around the site and monitoring wells between the site and the City's well field should be installed immediately regardless of any cleanup decision. Common sense tells us these public protective measures should have been installed five years ago prior to any Superfund study.

A final decision about the cleanup at Bowers Landfill should be postponed until serious questions are answered regarding groundwater flow, location and nature of wastes, and methane gas. In addition, any "cleanup" decision made using Ohio solid waste laws is not in compliance with the Superfund law requirement that protection of the public health and the environment should be a first priority. Solid waste laws are not relevant and appropriate for hazardous waste sites.

We believe permanent cleanup treatments could be considered if these major areas of concern were addressed. This request is not made lightly. We want a final solution as much as anybody. The problem is that there are many reasons to question the sensibility of EPA's plan. We are not questioning EPA's decision just to be difficult and our position is not unique as is evident in the Office of Technology Assessment study about the ineffectiveness of the Superfund program.

We feel strongly that EPA should answer all intelligent questions and overcome the many contradictions in their study rather than leave us with a faulty "cleanup" at Bowers. Nobody in this county wants to be fighting this battle again in 15 years. EPA's proposed remedy does not give us the least risk possible and we think their decision is influenced by cost. Pickaway Countians should not sacrifice their quality of life for economics.

We have not heard from anyone in the County who likes the EPA's proposed decision. Senator Jan Long, the Pickaway County Commissioners and several City officials and councilmen have similar concerns and are submitting their statements to USEPA. Ohio EPA representatives even agreed that all our concerns are valid in a meeting on Tuesday with Senator Jan Long and ACTION representatives. In fact, they stated their comments about the proposed plan would include similar concerns. However, it appears they are resigned to working within the inadequacies and politics of the system and succombing to USEPA's haste to meet its half-year report deadline of March 31, 1989.

We think USEPA should reassess their priorities - a first being to address adequately the cleanup of Superfund sites. We think OEPA should reassess their priorities - a first being to insist that the Superfund work as the law intended.

As Pickaway County residents, we will not sacrifice our environment to become another statistic for another study about the ineffectiveness of the Superfund program. We will not stand by while poor decisions cost us misery and money in the future.

Thursday, March 16, 1989

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road (rear), Circleville, Ohio 43113
1-614-474-1240

ACTION is a public interest environmental organization formed in September, 1984, for the specific purpose of working on the Bowers and Barthelmas Landfills which threaten to contaminate the Teays Aquifer, our water supply, and the Scioto River. Since ACTION's origin, we have become involved in addressing all potential environmental problems within our county. ACTION's projects and services include but are not limited to the following: Bowers Landfill Superfund site, Barthelmas landfill, sewage/sludge application on farmland, water and soil monitoring in coordination with the Student Environmental Health Project of Vanderbilt University, PPG's regional hazardous waste incinerator, PPG's plant site groundwater contamination, solid waste management and recycling, school programs, and the ACTION office which has extensive environmental resources including news articles, books, videotapes, magazines, legislative bills, government publications, and newsletters from other environmental organizations.

ACTION has worked hard to bring a greater awareness to our community of our environmental problems and the many threats to the county's air, water and soil. By attending environmental conferences, speaking to the young people in the schools who will eventually inherit these problems, working with the EPA, industry and other government officials for more citizen participation, and speaking to area organizations, we think we are making a significant impact for good in Pickaway County.

ACTION's members are highly motivated and dedicated to cleaning up existing problems and from preventing other problems from ever materializing by making government responsible to those people who are most affected by pollution. Environmental impacts need to be a major consideration when planning growth for our community in order to not jeopardize our present or future economy. Industry can be a responsible and considerate neighbor by our insisting that the laws be enforced and that new laws be passed that give incentives for elimination of both solid and hazardous wastes by safe methods such as waste exchange, neutralization, source reduction, bacterial treatment, and recycling.

ACTION NEEDS YOUR HELP! We need you in this immense task. We need your time and contributions to continue and further our work.

I WANT TO JOIN A.C.T.I.O.N.

Complete this form and mail to ACTION, 111 Island Road, Circleville, Oh 43113
(To be a voting member, you must be a Pickaway County resident.)

Name____

Address____

Phone______________________Confidential Membership (check here) _____

Membership fee per year - Please make checks payable to ACTION.
(Includes three newsletters a year)

Single..................$10 Family.................$15.00

Sponsor.................$25 Benefactor........$50 & above

Corporate..............$200

Retired, Student or Limited Income.........................$ 5.00

I want to be an ACTION volunteer (check here)

ACTIVISTS CONCERNED WITH TOXICS IN OUR NEIGHBORHOODS
111 Island Road, Circleville, Ohio 43113 1-614-474-1240

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Plan to clean up Circleville dump prompts doubts

Some wonder how city water supply might be affected

By Don Baird
Dispatch Staff Reporter

CIRCLEVILLE, Ohio — Some people here, including Mayor Michael E. Logan, are questioning a federal cleanup plan proposed for a controversial toxic waste dump.

The U.S. Environmental Protection Agency will seek public comments on the plan at a 7 p.m. hearing Tuesday in Circleville High School.

The EPA wants to cap the abandoned Bowers Landfill with 4 feet of clay and topsoil, fence the site and monitor ground water with test wells. The landfill is within 2 miles of Circleville's four municipal water wells.

The EPA has estimated the cleanup would take 10 months and cost $4.2 million.

THE EPA once rated the toxicity of the landfill at only slightly lower than that of the infamous Love Canal area near Niagara Falls.

Since 1983, the Bowers Landfill has been on the Superfund National Priorities List of the worst uncontrolled and abandoned hazardous waste sites.

Logan wants to know who will pay to monitor the ground water after the EPA finishes the cleanup. He also questions the EPA's assertion that the landfill poses no threat to city wells.

"It could cost us $30,000 a year to monitor those (test) wells," Logan said. "We want them monitored, but the city doesn't need to absorb the cost."

The EPA report concludes that municipal wells are safe from contamination because ground water from the landfill flows west toward the Scioto River, instead of south toward the wells.

"I don't think anybody understands that aquifer," Logan said.

The mayor said he is withholding judgment on the EPA plan. "I want to see what comes out of the meeting," he said.

Physician Gary L. Gillen and others in a citizens group, Activists Concerned with Toxics in Our Neighborhoods, have filed a written objection, saying the plan is inadequate. They plan to speak at the hearing.

"It falls short," Gillen said. "Everybody who's looked at these problems prefers some treatment that would permanently protect a site."

THE EPA plan does not call for removing all toxic material, and it would not protect the landfill from flooding, which occurs annually, he said. A dike should be built around the landfill, he said.

Bowers Landfill is northwest of Island and Circleville-Florence Chapel roads and west of Rt. 23. It opened in 1958 and closed in 1968.

Gillen accused the EPA of attempting "to minimize hazards to avoid frightening local residents, and to minimize problems to avoid putting too much economic stress on the responsible parties."

"Any containment plan is doomed to fail, and ... such plans must be reinforced to the maximum and monitored carefully to discover the failure when it occurs," he said.

The EPA said, "the overall risk is low."

Circleville folks rap EPA landfill plan

3-1-89

By Don Baird
Dispatch Staff Reporter

CIRCLEVILLE, Ohio — The federal government's proposed program to clean up a toxic waste dump at this city's western edge was criticized by Pickaway County residents yesterday as poorly planned and inadequate.

"I'm pitifully disappointed," said John Stolarz of Circleville.

When Stolarz asked whether others among the 65 people who showed up to comment on the plan felt the same way, most raised their hands and some applauded or cheered.

Stolarz spoke at a public hearing held by the U.S. Environmental Protection Agency at Circleville High School yesterday to measure the community's acceptance of its plan to cap the abandoned Bowers Landfill with 4 feet of clay and topsoil.

SINCE 1983, the landfill has been on the Superfund National Priorities List as one of the nation's worst uncontrolled and abandoned hazardous waste sites.

The landfill is on 12 acres a mile northwest of Circleville and about 25 miles south of Columbus.

Most people who spoke criticized the EPA's choice of remedies, which carries an estimated price tag of $4.2 million.

The EPA chose its cleanup plan, which calls for fencing Bowers Landfill and monitoring ground water with at least 15 test wells, from among nine alternatives — from zero cost for taking no action to more than $13 million for a more expensive plan that included a flood protection dike.

The preferred plan also includes restricting access to the landfill, management of surface debris, improvement in erosion control, flood protection and drainage, and using clay to cover the landfill.

STOLARZ SAID he thought the toxic wastes dumped at the landfill should be dug out and destroyed or treated to render them harmless.

The landfill, northwest of Island and Circleville-Florence Chapel Roads, opened in 1958 and closed in 1968. It accepted chemical and industrial waste as well as domestic refuse.

In 1986, the EPA identified PPG Industries and E.I. du Pont de Nemours & Co. as partly responsible for contamination in the landfill.

Recent tests at the site indicate "the overall risk posed by the site is low," an EPA report said. Earlier tests rated toxicity of the landfill at only slightly lower than that of the infamous Love Canal near Niagara Falls, N.Y.

Cynthia Gillen, a spokesman for Activists Concerned With Toxics in Our Neighborhood, said the EPA plan leaves too many questions unanswered, including the question of what happened to contaminants measured in earlier tests.

"Basically, I think they're going through the motions," Gillen said. "They haven't been convincing."

SHE SUGGESTED toxic material detected earlier may have leaked from the landfill and be making its way via ground water to Circleville's municipal wells, fewer than 2 miles south of the landfill.

She said an EPA consultant admitted during the hearing that he could not rule out such a possibility.

She also said the EPA admits that if Bowers Landfill had operated after new laws had been put into effect, it would have been subject to stricter cleanup requirements as a hazardous waste site instead of being treated as a solid waste landfill.

In written comments submitted to the EPA, Gillen said, "It would appear that U.S. EPA has conducted a useless study that has no conclusive data."

Comments from Government Agencies and Officials

TUESDAY 7 MARCH, 1989

3/28 USEPA - CHS

To: The President and members of City Council,
Circleville, Ohio

Whereas, in the opinion of many concerned informed citizens, it has not been conclusively demonstrated that the well field which supplies water for the City of Circleville is completely safe from contamination by hazardous wastes deposited in the Superfund Site known as the Bowers Landfill, I strongly urge that the President of City Council write the Ohio and U.S. Environment Protective Agencies expressing our concern, and requesting that adequate ground monitoring wells be placed in locations appropriate to assuring protection of our water supply, i.e. between our well bed and the Landfill, and that this action be taken as part of that remedial action which is eventually selected.

Such written comment must be submitted to the U.S. EPA by March 16, 1989.

Respectfully submitted,

Robert N. Phillips
Councilman, First Ward

Georgette Nelms
Community Relations Coordinator
Office of Public Affairs
U.S. EPA Region 5
230 South Dearborn
Chicago, Il 60604

ROBERT N. PHILLIP . D.D.S., INC.
147 PINCKNE TREET
CIRCLEVILLE, O 43113

PM
8 MAR
1989

Corgett Helms Comm. Rel. Dir.
Office of Public affairs
US EPA Region 5
230 S. Dearborn
Chicago IL 6 604

Georgette Nelms
Community Relations Coordinator
U.S. EPA Region 5
230 S. Dearborn Ave.
Chicago, Ill. 60604

March 9, 1989

Dear Ms. Nelms:

The point of this letter is not necessarily to communicate my disagreement over the method in which the EPA has recommended to "remedy" the problem at the site of the Bowers Landfill as much as it is to express my displeasure over the manner in which the alternative was presented to local citizens.

I feel the EPA was ill-prepared to fully respond to many of the questions posed by members of the community who attended the public information meeting on Feb. 28, 1989 at Circleville High School.

As a Circleville city councilman, I feel taxpayers deserve and should expect better response from governmental bodies than what they received from the EPA. In particular, inquiries concerning the decision not to physically remove waste from the site were met with the response that total removal of the waste was simply not one of the options investigated.

The remedy recommended by the EPA has some merit but I feel it doesn't go far enough to provide for the future safety of the 13,000+ citizens who depend on the Circleville water supply. Many members of this community, including myself and other councilmen, feel additional monitoring precautions should be included in your remedy.

One such precaution would be to locate ground water test wells at strategic points between the landfill and Circleville's water field. As your plan presently states, most test wells are in the immediate area of the landfill.

I realize the EPA becomes involved in battles on many fronts when making decisions that may satisfy some groups but could cost others millions of dollars. Nevertheless, it is important not to misjudge the impact your decision will have on those who live and raise their families here. It is hoped your final solution reflects at least some of this community's interests.

Sincerely,

David M Crawford

David M. Crawford
Circleville City Councilman
431 N. Court St.
Circleville, Ohio 43113

Jan Michael Long
State Senator

Ohio Senate
17th District

MEMORANDUM

TO: Ohio Environmental Protection Agency
United States Environmental Protection Agency

FR: Jan Michael Long
State Senator
17th District Ohio Senate

RE: Bowers Landfill Super Fund Sight/Public Comment

DATE: March 14, 1989

Thank you for the opportunity to allow me to submit to you this date my public comment for the record and to be reviewed by the respective Environmental Protection Agencies in their consideration of rendering a record of decision on the closure and cleanup of the Bowers Landfill Super Fund Sight. I submit these comments not only as the State Senator who represents the geographic area known as Circleville and Pickaway County in the 17th Ohio Senate District, but also as a citizen of the City of Circleville.

While our community and indeed our state is most interested in forging a remedy to the Bowers Landfill problem, all of us want to assure ourselves that such a cleanup is one that is safe, protects the environment for present generation, as well as future generations, and also is one that we will not have to revisit in the near future. Based on these underlying premises, my public comment is a request for the US EPA region 5 and the Ohio Enviornmental Protection Agency to withhold or postpone any records of decision on the Bowers Landfill closure until some major areas of concern are addressed and satisfactorily examined by a thorough study of additional information necessary to make a permanent environmentally sound decisions.

Jan Michael Long
State Senator
Ohio Senate
Statehouse
Columbus, OH 43266-0604
614-466-8156

Scott E. Ellsar
Legislative Aide
Pam Spangler
Secretary

Committees:
Education and Retirement
(Ranking Minority Member)
Finance
Highways and Transportation

Having attended the hearing on the public comment and question session some two weeks ago, there were some matters that came to my attention and that raised some concerns on my part. For example, the Bowers landfill is perhaps one of the most toxic and hazardous in this state, if not in the United States. Yet, the closure standards that would be applied to the Bowers Landfill would be those closure requirements that govern the closure of a solid waste site. It is my understanding that this is acceptable because of the technical requirements of the law as it relates to the time of the last use of Bowers Landfill. Certainly, if the landfill contains materials that would qualify it as a hazardous or toxic waste landfill in 1989, then it seems to only make sense that the closure should be made pursuant to the guidelines and regulations governing hazardous waste landfills. The mere fact that termination of use was some two decades ago should not remove the closure from the hazardous waste closure requirements.

Secondly, it was my understanding at the public hearing that the alternatives for closure need only satisfy a thirty-year life span requirement. From the public safety standpoint, as well as from the public funding standpoint, it seems as though a permanent solution should be pursued and not one that may require additional closure remedies in twenty or thirty years. As a legislator who is most concerned with funding issues, I can assure you that I would applaud efforts that deal with one time permanent costs, as opposed to future potential unknown monetary costs for intermedial work.

Next, I would like to comment on areas that appear to not have been thoroughly examined in the initial alternative proposals. The issues that should be more thoroughly studied and further data collected, would be issues dealing with the groundwater flow outside the immediate area of the site. Perhaps the installation of monitoring wells between the site and the city wells would adequately address this issue. Additionally, there appears to have been limited if any, testing at areas outside the site to determine the location of any migrating waste. Before we can talk about total containment, it would be helpful to fully understand the extent of the contamination.

Finally, the threat of methane gas migration seems to be one that has not been adequately examined in the process of formulating these porposals. The question of the absence of gas venting systems to prevent lateral migration of methane gas should be addressed.

Thus, considering all of the unknown and unanswered variables in this very complex problem, I would strongly urge the US EPA to postpone any record of decision until these questions are satisfactorily examined and answered.

Again, thank you for allowing me the opportunity for this additional public comment.

The City of Circleville

DEPARTMENT OF PUBLIC UTILITIES
114 WEST FRANKLIN STREET
P.O. BOX 209
CIRCLEVILLE, OHIO 43113
TELEPHONE (614) 477-2551

MICHAEL E. LOGAN
MAYOR

ATWOOD P. JONES, P.E.
DIRECTOR OF PUBLIC SERVICE

March 15, 1989

Ms. Erin Moran
Remedial Project Manager
Remedial and Enforcement Branch (EHS-11)
US Environmental Protection Agency
230 South Dearborn Street
Chicago, IL 60604

Dear Erin:

This letter will serve to notify the USEPA of the City of Circleville's comments on the "Feasibility Study for the Bowers Landfill, Circleville, Ohio" dated February 3, 1989.

On page 1-5 of the report the first paragraph states "According to information on file with the OEPA, the majority of waste materials deposited on the site consisted of residential refuse collected by the City of Circleville as well as by several private haulers in the Circleville area." That part of the statement referring to refuse being collected by the City of Circleville is incorrect. The City of Circleville has never collected residential refuse with City crews and equipment nor has the City contracted such work to private contractors. Residential refuse collection within the City of Circleville has been and continues to be the responsibility of each individual property owner and as such each property owner makes arrangements with individual haulers to haul their trash.

On page 3-38 under the paragraph entitled "Erosion Control and Drainage Improvements" the report discusses the installation of sheet-piling protection at the north end of the landfill adjacent to the Scioto River in order to provide containment for the stone riprap to be installed at that location. The City's position is that both the sheetpiling protection and the amount of riprap to be installed is not sufficient given the fact that during severe floods the entire north leg of the landfill is at risk. According to a report prepared in October 1966 by the Department of the Army, Huntington District, Corps of Engineers entitled "Flood Plain Information, Scioto and Olentangy Rivers, Ohio, Main Report", the 100 year flood elevation at the Bowers Landfill site is approximately 675 feet above mean sea level (msl). This 100 year flood will be over the top of the existing landfill by approximately 10 feet. The City requests that the sheetpiling protection be extended to the east on the up river side and that the length of the riprap be extended considerably to protect the north leg of the landfill that protrudes out into the flood plain area.

The south end of the landfill is designed to have stone riprap on the end that protrudes into the floodplain. Since this area is immediately adjacent to the Florence Chapel Road bridge (Red River Bridge) over the Scioto River the entire flow of water in the Scioto River must past underneath this bridge and severe scouring problems may occur to the edge of the landfill at this location under severe flood conditions. The City's position is that sheetpiling needs to be installed in this area to prevent the undermining of the riprap in this area and the riprap itself needs to be extended considerably in order to provide adequate protection in this area.

The final major area of concern of the City of Circleville with the report involves the lack of specific recommendations for a ground water monitoring system that will serve to protect the City of Circleville's public water supply. The City's existing well field is located adjacent to the water treatment plant approximately 1 1/2 miles south of the Bowers Landfill. Approximately eight years ago the City of Circleville undertook an engineering investigation to determine whether a future well field could be located at the old pumping station site on the west side of the Scioto River off of River Road. The site is identified on Drawing Number 1 Vicinity Map as "Pumping Station". The City's report indicated that the area around the old pumping station, which is currently still owned by the City of Circleville would serve adequately as a future well field site for the Circleville water treatment plant. There exists a 16" watermain that runs from the old pumping station site to the current water treatment plant on Island Road that could transmit raw water to the treatment plant.

The City feels that it is absolutely essential that adequate monitoring for both of these locations is necessary in order to adequately protect the City of Circleville's public water supply. The City is of the opinion that additional monitoring wells need to be installed off site of the Bowers Landfill and an appropriate monitoring program be devised so that these two sites would be adequately protected from any migration of hazardous materials from the Bowers Landfill. I would suggest that the construction of additional monitoring wells and and an adequate monitoring program be developed as part of the work to be done on whichever alternative the USEPA selects as to the proposed solution to the problems at Bowers Landfill. The City of Circleville will want to be involved in the development and review of such an addendum to the proposed plan.

If you have any questions on the above matters, please do not hesitate contacting me.

Very truly yours,

Woody

Atwood P. Jones, P.E.
Director of Public Service

City of Circleville
MICHAEL E. LOGAN, MAYOR
CITY HALL, 127 SOUTH COURT STREET
CIRCLEVILLE, OHIO 43113-1611
TELEPHONE (6[illegible]) 477-2551

March 15, 1989

Ms. Erin Moran
Remidial Project Manager
Remidial and Enforcement Branch (EHS-11)
US Environmental Protection Agency
230 South Dearborn Street
Chicago, IL. 60604

Dear Ms. Moran:

This letter is regarding the City of Circleville's comments on the Feasibility Study for Bowers Landfill, Circleville, Ohio dated February 3, 1989.

The first paragraph on page 1-5 stating the majority of waste materials deposited on the site consisted of residential refuse collected by the City of Circleville as well as by several private haulers in the Circleville area is not correct. I would like to emphasize the City of Circleville does not collect residential refuse with City crews and vehicles nor does the City contract such work. Residential refuse collection within the City of Circleville has been and continues to be the responsibility of each individual property owner and each individual property owner makes arrangements with private haulers to haul their refuse.

The City's position concerning erosion control and drainage improvements is that both the sheetpiling protection and the amount of riprap to be installed is not sufficient due to the fact that during severe flooding the entire end of the dike is at danger. The City requests that the sheetpiling protection to be extended to the east on the up river side and that the length of the riprap to be extended extensively to protect the north end of the landfill that protrudes out into the flood plain area.

CIRCLEVILLE, OHIO IN 1836

Since the south end of the landfill is immediately adjacent to the Florence Chapel Road bridge over the Scioto River, the entire flow of water in the Scioto River must pass beneath this bridge and serious scouring problems may occur to the edge of the landfill at this location under serious flood conditions. The City's viewpoint is that additional sheetpiling needs to be installed in this area to prevent the undermining of the riprap and the riprap itself needs to be extended considerably in order to provide adequate protection in this area.

A major interest of the City of Circleville concerns the lack of specific recommendations for a ground water monitoring system that will serve to protect the City of Circleville's public water supply. The City's existing well field is located adjacent to the water treatment plant approximately 1 1/2 miles south of the Bowers Landfill. Approximately eight years ago the City of Circleville undertook an engineering investigation to establish whether a future well field could be located at the old pumping station site on the west side of the Scioto River, off of River Road. The site is identified on drawing number 1 on the Vincinity Map as "Pumping Station". The City's report implied that the area around the old pumping station, part of which is currently still owned by the City of Circleville would serve adequately as a future well field site for the Circleville water treatment plant. There exists a 16" watermain that runs from the old pumping station site to the current water treatment plant on Island Road.

I would like to stress that the City is extremely concerned in having adequate monitoring for both of these locations in order to sufficiently protect the City of Circleville's public water supply. The City strongly suggests that monitoring wells be installed off site of the Bowers Landfill in such a manner that would detect any migration of hazardous materials in the direction of these facilities.

My opinion is that additional monitoring wells need to be drilled and an appropriate monitoring program be devised so that these two sites would be adequately protected from any migration of materials from the Bowers Landfill. I would suggest that the construction of additional monitoring wells and adequate monitoring wells and a sufficient monitoring program be developed as part of the work to be done on whichever alternative that the USEPA selects as to the suggested solution to the problems at Bowers Landfill. The City of Circleville will want to be involved in the review and development of such an addendum to the proposed plan.

If you should have any questions regarding the above concerns, please do not hesitate contacting me.

Very truly yours,

Michael E. Logan
Mayor of Circleville

OhioEPA
State of Ohio Environmental Protection Agency
Central District Office
P.O. Box 1049, 1800 WaterMark Dr.
Columbus, Ohio 43266-0149
(614) 644-2055

Richard F. Celeste
Governor

March 15, 1989

RE: Comments on Proposed Plan
for Bowers Landfill

Georgette Nelms
Office of Public Affairs
U. S. EPA, Region V
230 South Dearborn Street
Chicago, Illinois 60604

Dear Ms. Nelms:

Ohio EPA has several comments on the Proposed Plan for Bowers Landfill, Circleville, Ohio. Because of uncertainties not addressed or answered in the Remedial Investigation (RI) or Feasibility Study (FS), Alternative 4 may be viewed as an interim action rather than a final remedy. State ARAR's will only be met by Alternative 4 if the conditions at the site remain stable. If the conditions change, State ARAR's may not be met by this alternative. Therefore, a more detailed contingency plan for emergency removal and a more detailed ground water monitoring program are necessary if the selected remedy is to be accepted as the remedial action.

A detailed contingency plan and a more extensive ground water monitoring program must be included in the Record of Decision (ROD). Because U. S. EPA maintains that the States have only those rights set forth in Sections 113 and 121 of CERCLA and that the States are somehow precluded from enforcing State laws at NPL sites, addressing these issues during the design phase will not afford the State of Ohio substantial meaningful involvement in the initiation, development, and selection of the remedial action or insure that the remedy complies with State law. Given the limited role assigned to the State by U. S. EPA, considerable detail in the remedial alternative must be agreed to immediately if Ohio EPA is to concur with the ROD.

The Proposed Plan does not describe the contingency plan that will be implemented should the preferred remedial alternative fail. Therefore, the ROD should address those situations (e.g. detection of ground water or surface water contamination, erosion of the cap, damage to the fence, production of leachate or gas) that will trigger the implementation of the contingency plan. The ROD should also address the levels of contamination that will trigger the implementation of the contingency plan, the actions that will be taken as part of the contingency plan, and identify those who will carry out the contingency plan.

The Proposed Plan also does not adequately describe the ground water monitoring program that will be established as part of the preferred remedial alternative. Therefore, the ROD needs to specify which wells will be sampled, how often the wells will be sampled, and for what parameters the wells will be sampled. The wells should be sampled on a monthly or bimonthly basis for the first year and on a quarterly basis for the next two to five years. If the levels of contamination in the ground water do not increase over this time period, then a reduction in the frequency of sampling may be considered. The samples from the wells should be analyzed for all target compounds each time the wells are sampled.

The installation of additional ground water monitoring wells is also necessary to develop a monitoring well system that will adequately detect potential future releases of contaminants from the site. Well clusters should be installed in the following locations:

1. Between Well Location 5 and Well Location 6.

2. Between Well W-10 and the bend of the landfill.

3. Offsite, between the landfill and the Circleville municipal well field.

Because of flooding of the Scioto River and uncertainty about the amount, composition, and mobility of wastes in the landfill, conditions at Bowers Landfill are likely to change. In order to fully comply with State law and protect the environment, the ROD must have a contingency plan that can be easily and rapidly implemented and a ground water monitoring system that will adequately detect any potential future releases of contaminants.

Sincerely,

Deborah J. Strayton

Deborah J. Strayton
Office of Corrective Actions
Central District Office

cc Erin Moran, U.S. EPA, Region V
Maury Walsh, OEPA, Deputy Director
Dave Strayer, OEPA, OCA
Kathy Davidson, OEPA, OCA
Cindy Hafner, OEPA, Legal
Jack Van Kley, OAG
Chris Korleski, OAG
Jan Michael Long, Ohio Senate

COMMISSIONERS
GEORGE H. HAMRICK
JOHN F. FISSELL
RUTH NEFF

CLERK-ADMINISTRATOR
TERRENCE J. BERRIGAN
Telephone 614-474-6093
614-474-6094
614-474-6096

PICKAWAY COUNTY
BOARD OF COUNTY COMMISSIONERS
ROOM 5, COURT HOUSE
CIRCLEVILLE, OHIO 43113

March 15, 1989

Georgette Nelms
Office of Public Affairs
Chicago, Illinois 60604

Ms. Nelms,

After reviewing the EPA's planned response to the Bowers Landfill problem, we feel it is our obligation to offer our comments for the public record.

Many citizens of Pickaway County have devoted a great deal of time and effort in studying the technical aspects of the EPA's studies and recommendations.

They have presented to us their concerns and after considering the information, we would strongly request the USEPA Region 5 and the Ohio EPA to postpone a Record of Decision until the following four major areas of concern are re-considered:

1. We have received conflicting accounts as to the direction of the groundwater flow. If the USEPA did not study groundwater flow outside the immediate area of the site, an inaccurate assumption of the potential risk to our water supply could be made.

2. According to reports, tests to discover the contaminants have generally been restricted to around the site. Without testing larger areas around the landfill, no evidence of off-site migration could be determined.

3. We have been informed that landfills can exhaust mathane gas as a by-product. If so, without a gas venting system, surrounding homes would be exposed to a risk of methane gas contamination.

4. Concerns have been raised that the EPA is planning to use cleanup standards based on "current Ohio solid waste landfill closures standards." We also share those concerns as solid waste closure laws are not appropriate for hazardous waste sites.

COMMISSIONERS
GEORGE H. HAMRICK
JOHN F. FISSELL
RUTH NEFF

CLERK-ADMINISTRATOR
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PICKAWAY COUNTY
BOARD OF COUNTY COMMISSIONERS
ROOM 5, COURT HOUSE
CIRCLEVILLE, OHIO 43113

In closing, the Pickaway County Board of Commissioners urges you to not commit to one plan of action until all these matters have been publicly addressed in greater detail.

Sincerely,

THE PICKAWAY COUNTY BOARD OF COMMISSIONERS

John F. Fissell
Ruth E. Neff
George H. Hamrick

jm

AFTER FIVE DAYS, RETURN TO
PICKAWAY COUNTY
BOARD OF COMMISSIONERS
BASEMENT, COURT HOUSE
CIRCLEVILLE, OHIO 43113

PM
15 MAR
1989

SAVE
YOUR VISION
WEEK

Georgette Nelms
Community Relations Coordinator
USEPA Region 5
Office of Public Affairs
5PA-14
230 South Dearborn Street
Chicago, Illinois 60604

OhioEPA
State of Ohio Environmental Protection Agency
Central District Office
P.O. Box 1049, 1800 WaterMark Dr.
Columbus, Ohio 43266-0149
(614) 644-2055

Richard F. Celeste
Governor

March 16, 1989

RE: Bowers Landfill

Georgette Nelms
Office of Public Affairs (5PA-14)
U. S. EPA, Region V
230 South Dearborn Street
Chicago, Illinois 60604

Dear Ms. Nelms:

Enclosed are the originals of the comment letters that Ohio EPA sent to you by FAX on March 15, 1989. These letters include Ohio EPA's comment letter on the Proposed Plan and State Senator Jan Michael Long's comment letter on the Feasibility Study and the Proposed Plan for Bowers Landfill.

If you have any questions, please contact me at (614) 644-2055.

Sincerely,

Deborah J. Strayton

Deborah J. Strayton
Office of Corrective Actions
Central District Office

Comments from Potentially Responsible Parties

2 380 CV-084 REV 11-87

DU PONT

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED

CIRCLEVILLE, OHIO 43113

March 15, 1989

Ms. Georgette Nelms
Community Relations Coordinator
Office of Public Affairs
US EPA Region 5
230 South Dearborn
Chicago, Illinois 60604

Dear Ms. Nelms:

Enclosed is a copy of the remarks I made regarding the Bower's Landfill during the public meeting held at the Circleville High School, [illegible] Clark Drive, Circleville, Ohio on March 28, 1989.

If you have any questions, please contact me.

Sincerely,

R. E. Berlin
Site Services Superintendent
Du Pont Circleville Plant

JHS008/ah
Enclosure

CONTACT:

Ron Berlin, Site Services Superintendent
Du Pont Circleville Plant
Phone: 614-474-0240

* * * * * *

DU PONT STATEMENT ON BOWERS LANDFILL

From 1965 to 1968 we disposed of Mylar® polyester scraps and rolls that didn't meet customer specification in the landfill. We also disposed of Mylar® polymer, which amounts to the same material solidified in large pieces. Mylar®, as you probably already know, is a thin sheet of film with a variety of everyday uses such as food wrap and packaging. Chemically, Mylar® is the same as the polyester fiber that is in much of our clothing.

Small quantities of materials such as paint, degreasers, lab chemicals, and maintenance supplies have gone to the landfill, but the bulk of our materials in the landfill is Myla[illegible].

When concerns developed over the landfill, we felt it was important that a study be done to determine whether the landfill presented any threat to health or the environment. For that reason, we agreed along with PPG to jointly fund the $700,000 feasibility study.

The feasibility study lists nine alternatives for dealing with the landfill. EPA has already stated that it prefers Alternative No. 4. We feel Alternative No. 3 is the more appropriate method to address any concerns about the landfill. Let me remind you of the provisions of the two alternatives. Both of the alternatives call for groundwater monitoring, restricting use of and access to the site, managing surface debris, and improving erosion control, flood protection and drainage.

In addition, Alternative No. 3 calls for areas of the existing landfill cap which shows erosion to be identified and repaired with natural clay soil. Additional clay would be filled in to prevent surface water from forming in ponds. Maintenance and improvements to the existing vegetation cover would be made to inhibit erosion. The cover would be inspected regularly for st[illegible] integri[illegible]. Alternative No. 4, pre[illegible] by the EPA, calls for cutting down trees and similar vegetation that have grown up over the last 20 years and installing a new clay cap over the landfill.

(JMS004/ab)-1
2/28/89

While the cost of Alternative No. 4 is higher than that of Alternative No. 3, our main concern is not the cost but the environmental intrusion that Alternative No. 4 might cause. In our opinion, removing existing vegetation does not appear to be warranted; will disrupt the ecological system currently in place; will have a detrimental effect on the stability of the fill side slope; and will create a continuing, long-term maintenance problem.

The remedial investigation indicates that there is no continuing release of contaminants from the site. The study does not indicate that the landfill presents a substantial threat which would require the severe remedial measures called for in Alternative No. 4. Based on currently available data, securing the site and providing regular, long-term monitoring is all that is called for at the site. In the unlikely event that monitoring indicates that a problem is developing, prompt remedial action can be taken.

Although there is no imminent health or environmental risk posed by the site, we feel it is prudent to monitor the site to assure that there is no future problem. We feel that Alternative No. 3 is a more than adequate method to assure that the health and environment of the community is protected.

$ $ $ $ $

(JMB004/sh)-2
2/28/89

APPENDIX B

COMMUNITY RELATIONS ACTIVITIES AT BOWERS LANDFILL

COMMUNITY RELATIONS ACTIVITIES AT BOWERS LANDFILL

Community relations activities conducted at Bowers Landfill to date have included the following:

- U.S. EPA conducted community interviews with local officials and interested residents (March 1983).
- U.S. EPA established an information repository at the Pickaway County District Library in Circleville, Ohio (July 1984).
- U.S. EPA held a public meeting to discuss and solicit public comments on the consent order (March 1985).
- U.S. EPA held a comment period on the consent order (February 22 to March 25, 1985).
- U.S. EPA prepared a community relations plan (May 1985).
- U.S. EPA developed a response to public comments (responsiveness summary) on the consent order (July 1985).
- U.S. EPA held a public meeting to discuss the responsiveness summary (August 1985).
- U.S. EPA distributed an update on activities at Bowers Landfill (November 1985).
- The Bowers Landfill Information Committee was established. Twelve meetings were held before and during the remedial investigation and feasibility study (RI/FS) (November 1985; January, March, June, August, and October 1986; March, June, and September 1987; and January, June, and November 1988).
- U.S. EPA developed and distributed a glossary and other materials to assist people with non-technical backgrounds in understanding sampling results presented in RI technical memoranda (May 1987).
- U.S. EPA developed and distributed a fact sheet on applicable or relevant and appropriate requirements (ARARs) (April 1988).

- U.S. EPA developed and distributed a fact sheet explaining the preliminary results of the RI (June 1988).

- U.S. EPA developed and distributed a fact sheet explaining the final RI results and the results of the endangerment assessment (EA) (September 1988).

- U.S. EPA held a public meeting in Circleville to discuss results of the RI and EA. Approximately 70 people attended (September 14, 1988).

- U.S. EPA released the FS report and Proposed Plan for public review and comment (February 1989).

- U.S. EPA held a public comment period on the FS and Proposed Plan (February 14 to March 16, 1989).

- U.S. EPA prepared and distributed a fact sheet on the FS and Proposed Plan (February 1989).

- U.S. EPA held a public meeting in Circleville to present the results of the FS, describe the Agency's preferred remedial alternative for Bowers Landfill, respond to citizens' questions, and record public comments on the FS and Proposed Plan. Approximately 70 people attended this meeting. A transcript of the meeting is available in the information repository (February 28, 1989).

APPENDIX C

RESPONSE TO PUBLIC COMMENTS ON CONSENT ORDER FOR BOWERS LANDFILL CIRCLEVILLE, OHIO

JULY 1985

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO THE ATTENTION OF

RESPONSE TO PUBLIC COMMENTS ON CONSENT ORDER FOR THE BOWERS LANDFILL CIRCLEVILLE, OHIO

JULY 1985

INTRODUCTION

This report contains U.S. EPA Region V and Ohio EPA's response to public comments received on the consent order between U.S. EPA, Ohio EPA, E.I. du Pont de Nemours and Company, and PPG Industries, Inc., under which Du Pont and PPG will perform a Remedial Investigation and Feasibility Study of the Bowers Landfill in Circleville Ohio.

Included are the public comments received during the comment period, and the Agencies' responses to them. The comments are condensed and paraphrased in Section I for clarity or to combine similar comments. The full text of each written and verbal comment is included in Appendix D. Because numerous detailed comments were received on the subjects of community involvement and splitting samples, specifically, the Agencies' response to those are detailed in Appendices A and B.

As called for in the consent order, a 30-day public comment period was held. The comment period began February 22, 1985. In response to requests to extend the comment period, written comments were accepted until April 24, 1985. A public meeting was held on March 14, 1985 in Circleville, at which oral comments were received.

CONTENTS

Comments from ACTION

1. Contaminant plumes may have moved off site, and so would not be detected in the sampling plan as proposed.

   RESPONSE:
   It is unlikely that the contaminant plumes have moved entirely off the site, so the sampling sites in the immediate vicinity of the landfill are appropriate for this stage of the investigation. However, if the investigation should indicate a need for sampling farther off-site, the workplan allows for that. (See pages 4 and 15 of the workplan dated 5/29/84, which say that additional monitoring wells or surface water sampling can be added. The Quality Assurance Project Plan of 8/15/84, page 4 also says further investigation may be needed to define the extent of contamination. The need for further investigation will be determined as part of the RI report.)

2. Contamination could be over looked during droughts, so sampling should be required in the spring. Year-round sampling would give a better idea of the overall extent of contamination.

   RESPONSE: The workplan (page 15) requires sampling during low and moderate flows, so that samples will not be taken during drought conditions. The agencies want to find maximum levels of contaminants, so it isn't advisable to sample during flood times when contaminants would probably be diluted. Also, the sampling points may be inaccessible during flood times. However, if the initial rounds of sampling indicate a need for sampling during the spring, and the sampling points are accessible, that will be required.

3. Why isn't long-term sampling included in the agreement?

   RESPONSE: The consent agreement covers only the work needed during the remedial investigation/feasibility study phase of the project. The RI is intended to characterize the contamination from a site so that a decision can be made about the best actions to take at the site. By necessity, the investigation is limited in time. However, long-term monitoring is a very important consideration for the future, and will be considered during the feasibility study.

4. ACTION believes that a $400,000 ceiling has been placed on the cost of the RI/FS, and that the private parties don't have to pay for any costs beyond the original scope of the agreement.

   RESPONSE: There is no ceiling of $400,000 placed upon the cost of the RI/FS. The respondents' obligation is to complete a remedial investigation and perform a feasibilty study of the site in accordance with the RI/FS workplan.

5. The activities are strung-out over to long a time period. The activities should be scheduled simultaneously.

RESPONSE: Some activities are overlapped to limit the amount of time the study will take. Our experience shows that it's difficult to complete a remedial investigation in less time than is currently scheduled, and we believe the schedule is realistic in light of the complex nature of the work.

6. Sampling should be required to obtain baseline data prior to the start of the RI.

RESPONSE: Background samples (baseline data) are part of the proposed investigation. Surface water and sediment samples will be taken from the Scioto River upstream from the landfill. At least one monitoring well (W-9) will be located upgradient of the landfill site, from which soil and groundwater samples will be collected. Private wells located in the area also will be sampled. 25 soil samples, a number of which are located away from the landfill, should provide a reasonable basis to determine background soil inorganic concentrations near the site.

Most of the organic contaminants of concern at the site do not occur naturally. Therefore, any occurrence of the manufactured chemicals would be above natural background levels. If upgradient sampling locations are also significantly affected by these contaminants, then further investigation might be warranted to differentiate the site-related contaminants.

7. Split samples should be provided to the community.

RESPONSE: Addressed in attachment on split sampling.

8. Citizens must be notified prior to changes in sampling points, and should be able to provide input.

RESPONSE: Addressed in attachment on community involvement

9. There are descrepancies between the Hazardous Substance List, the detection limits list, and the list of chemicals to be sampled at the Bowers site. Why aren't specific compounds being analyzed?

RESPONSE: The Consent Agreement contains the correct CAS numbers for vinyl chloride and dichloroethane. The most recent Hazardous Substance List, and the detection limits for those substances, is attached. All parties analyzing samples during the_site investigation will be required to use this most recent list. In addition to the substances listed, dioxin will be sampled for, using detection limits of 100 ppt for water, sediments and soil. O-xylenes will be analyzed under total xylenes. Endosulfan I and II are listed as Endosulfan alpha and beta, respectively, on the HSL. Clorodibromomethane is listed on the HSL as dibromochloromethane. 1,2 diphenylhydrazine won't be analyzed because it breaks down easily during extraction so results aren't meaningful. Analytical methods for acrolein and acrylonitrile are not effective. Flurotrichloromethane (referred to as dichlorodifbronomethane in the comment) does not appear in water samples. All samples will be disposed of [illegible]

10. There should be quarterly public meetings.

RESPONSE: Addressed in attachment on community involvement.

11-13. There should be more than $11,000 allocated to implement the community relations plan. Monies not spent on community relations in one fiscal year, should be moved to the next. Community relations will not be performed if funds are not increased. Industry should cover the costs of community relations activities.

RESPONSE: As part of the administration of the Superfund program, Region V has resources (ie. staff time, travel budget) allocated to conduct community relations. Because there are so many sites, the Agency has contractors to assist the region's community relations staff. The contractors primarily prepare fact sheets, graphics aids for public meetings, etc. The $11,000 budget for contractor support for the Bowers site is separate from the RI/FS budget, and has already been obligated. Money not used one fiscal year is carried over to the next year. In our experience, $11,000 is more than adequate to supply the community with materials; the typical budget is $9,000. If more funds are needed, the region can request supplemental funds from Washington, or the work can be supplemented by in-house writers and graphic artists. The region has not found it appropriate to give the Respondents responsibility for producing community informational materials. It is U.S. EPA's policy to attempt to recover all costs for a site, including community relations funds.

14. There should be an evacuation plan and a warning system for the surrounding residents.

RESPONSE: Investigators from the Region's Emergency Response Section visited the site in May 1985 to assess whether any immediate threat may be posed by the site. The Agency concluded that there isn't a need for an evacuation plan during the RI/FS portion of the project. This decision is based on the following:

1) no air contamination was detected with specialized equipment used during the recent investigation;
2) the large distance on the downgradient side of the landfill between the drilling locations and the residences;
3) all drilling will occur outside the landfill boundaries so that any containerized material will not be affected;
4) because any gases encountered in the subsurface during drilling will be uncontained they will dissipate;
5) if any gases are released to the surface during drilling, the wide open area in which the landfill is situated allows for sample dissipation of gases, and
6) during drilling, the air will be continuously monitored.

A specialized Health and Safety Plan will be prepared for the site which will include an evacuation plan for site workers, consultation with the closest fire department, hospital, etc. A copy of the site-specific plan will be made available when it is completed.

15. There are discrepancies regarding the size of the landfill in various agency and legal documents. Also, the age of the landfill is referred to differently in various documents.

RESPONSE: The area to be investigated is the area of the property that was used for disposal of waste. That area is 12 acres, according to site records. On the long leg of the "L" shaped site, the landfill is 3000 ft north/south; it is another 1000 ft. in length on the short leg, which totals 4000 feet. The other dimensions are approximately 120-125 ft and 10-15 ft. The agencies consider 1958 or 1959 to be the year the site began operating, and 1968 as the year the site became inactive, although new information appears to show that the site closed in 1969.

16. The site should be fenced under the emergency criteria of the NCP because the site is being used for hunting, children's play and dirt biking.

RESPONSE: As a result of this comment, Region V's Emergency Response team evaluated the site in May 1985 to determine whether site access does pose an immediate health or environmental threat as defined by the National Contingency Plan. They determined that a fence is not necessary because:
1) the only unnatural material observed at the site was drums which all appeared to be empty, and plastic nonhazardous material, and
2) the site held a full spread of vegetation, which indicates that the topsoil may not be contaminated.

U.S. EPA will erect additional warning signs at the site, particularly at the small access paths along the west side of the site.

17. What is meant by trade secret? What types of information does this include? What recourse do citizens have to obtain information classified as CBI. All data should be released to ACTION.

RESPONSE: No information is being withheld regarding the site because it is considered a trade secret or business confidential, and we do not expect that any information generated during the RI/FS would meet the criteria for business confidentiality. The regulations explaining these concepts can be reviewed under Section 2.201-2.215 of the Code of Federal Regulations, and Section 149.43 of the Ohio Revised Code.

18. Any place the word "memorandum" is mentioned in the consent agreement, it should be replaced by "reports, documentation or sampling data."

RESPONSE: Whether a document is described as a memorandum or a report does not affect its confidentiality or make it exempt from disclosure. A document is judged on its content and not on its title. U.S. EPA does not withhold information only because it is labeled "memorandum."

19. Raw data should be provided to ACTION and the county health department at the same time EPA and industry receive it. Prior notice should be provided of any changes to the various plans.

RESPONSE: Addressed in the attachment concerning community involvement.

20. What are the standards for treating volatile samples?

RESPONSE: Volatile organic analysis of water samples must be performed within 7 days of the sampling date, and soil sample analysis must be performed within 10 days of the sampling date. Acid and base neutral extractable compounds, pesticdes and PCB water samples must be extracted within 5 days (10 days for soil) of sampling date and completely analyzed within 40 days of extraction. The holding time for low and medium concentration inorganic compounds, along with sample handling requirements, are listed in Appendix B, Table I of the Quality Assurance Project Plan.

A holding time is the period in which a sample remains stable enough to be analyzed, and therefore can be used to represent its source. "Not established" means the time is not a clearly defined number or a universally agreed upon number. In those cases, the agencies require that samples be analyzed in a timely manner that will allow the project to progress.

All samples will be taken, preserved, shipped and packed as indicated in Appendix B, Table I of the QAPP, as noted in the consent agreement.

21. Work should not continue unless EPA project directors are onsite. If not, industry should pay for a citizen representative to be onsite.

RESPONSE: As a result of this comment, and others received, U.S. EPA has arranged to have a representative from PRC Environmental Management, Inc. onsite overviewing all field activities to ensure that the PRPs comply with the Administrative Order and the National Contingency Plan. One representative will be on site during all field activities. An additional person will be on site when samples are taken. Ohio EPA plans to have a representative onsite during important field activities.

22. ACTION questions the U.S. EPA project manager's expertise.

RESPONSE: Erin Moran has an excellent educational and professional technical background, and is one of the senior members of Region V's Superfund staff. The role of the Remedial Project Manager is to manage and coordinate a number of technical projects and evaluations that are needed to successfully investigate a site. For specific parts of an investigation, the project manager may call upon the expertise of specialists who have specific training for that part and who can spend a great deal of time on that particular aspect. This is especially true for complex sites. It is not at all unusual for EPA project managers to seek assistance from a number of hydrogeologists, biologists, chemists or soil scientists, for example, to aid in a site investigation. At the March public meeting, Ms. Moran deferred questions to the hydrogeologist present because some citizens had specifically requested that a hydrogeologist attend the meeting. The region believes that Ms. Moran is able to fulfill the demanding job of project manager.

24. The gravel pitting operations around the landfill should be sampled, and if the gravel is contaminated, the pitting should be stopped. Signs should be placed around the perimeter of the landfill, and a gate should be placed at the SE entrance.

    RESPONSE: A steel cable with U.S. EPA warning signs has been placed at the southern entrance to the site, which limits access to the Bowers Landfill and to Quarry B. OEPA has observed the site, and has determined that the cable prevents removal of gravel from the site. Because the gravel pit is upgradient of the fill, it is unlikely that the gravel is contaminated by the site. To be sure, the RI/FS workplan calls for one surface water sample to be taken from the quarry east of the site.

25. EPA shouldn't be able to override local and state laws when choosing remedial actions. The community should be given 60 days to comment on the final remedial action, and a public meeting should be held.

    RESPONSE: The National Contingency Plan requires U.S. EPA to solicit public comments on its recommended remedial action for a site, and to consider those comments in making a final decision. EPA guidelines suggest a three week public comment period; however, the region can provide more time at its discretion, if it won't significantly interfere with the agency being able to take action at the site. A public meeting definitely will be held to discuss and take comments on the various cleanup alternatives.

    U.S. EPA and OEPA are required under law to dispose of hazardous waste in a safe and proper manner, and both agencies will go beyond what is minimally required to be sure hazardous wastes are disposed of properly.

26. A public meeting should be held to explain decisions made on the basis of the comments.

    RESPONSE: A public meeting will be held to describe the final consent agreement, and to explain how the comments have been responded to.

TRINITY LUTHERAN CHURCH
ALFRED KREBS

1. The industries responsible for the toxic waste problems at Bowers cannot be trusted to perform an honest investigation.

    RESPONSE: The Superfund law allows U.S. EPA to have the parties considered potentially responsible for hazardous materials at a site to pay for and conduct investigations and clean ups under the close supervision of EPA. In fact, the agency is required to try to recover any money it spends from private parties. Having the responsible parties conduct the investigations saves public monies for those sites where no potentially responsible parties can be found. However, the agency still maintains control over the objectivity of the investigations. The parties enter into a legal agreement with U.S. EPA (and in this case, Ohio EPA also) that requires them to perform the work using plans approved by the agencies, to follow EPA quality assurance guidelines, and to submit all information to the agencies for approval.

MURIEL WRIGHT

1. Work should begin as soon as possible on the investigation of the Bowers Landfill, so the comment period should not be extended 30 days.

   RESPONSE: U.S. EPA and Ohio EPA extended the comment period on the consent agreement because of numerous comments received that 30 days was insufficient time to evaluate the complex workplans. The agencies determined that extending the comment period would not significantly affect the investigation schedule.

CITY OF CIRCLEVILLE, DEPT OF PUBLIC UTILITIES
JOHN A. JORDAN

1. Who will actually be doing site work needs clarification.

   RESPONSE: The work will be done by a contractor or contractors hired by PPG and duPont. As soon as the names of the specific contractors are known, they will be made public.

   CH2M Hill and Warzyn have contracts with the federal government, and have worked on this project until the present time. Another U.S. EPA contractor, Camp, Dresser, McKee, and PRC Environmental Management, Inc. will function as consultants to U.S. EPA and Ohio EPA as the agencies overview the work performed by the respondents and their contractors.

2. Has U.S. EPA received permission from property owners to do testing on the site and adjoining areas?

   RESPONSE: Under the consent agreement, Part II, the Respondents are required to gain access to the property to do the required work. Access to the landfill has been achieved, and that agreement is attached to the consent agreement in Appendix A. The Respondents also are required to obtain any agreements necessary to provide access to U.S. EPA, Ohio EPA and their authorized representatives.

3. Who will be on the project team?

   RESPONSE: Erin Moran is the Remedial Project Manager for U.S. EPA for the Bowers Landfill project. Lundy Adelsburger is the project manager representing Ohio EPA. Also, U.S. EPA has contracted with the firm

PRC Environmental Management, Inc. to represent Ms. Moran on site during all field activity to ensure that the Respondents comply with the consent agreement and the National Contingency Plan.

4. The city should have access to test data as it becomes available, particularly groundwater analyses. Who will do analyses for the agencies, and other parties.

   RESPONSE: Addressed partially in attachment on community involvement. U.S. EPA and Ohio EPA contract with labs to perform the analyses. Other parties can have any lab that follows the Quality Assurance Project Plan for the site perform their analyses.

5. What steps will be taken to ensure that the monitoring wells don't contaminate the city's wells? Are 100 ft. wells deep enough? Will there definitely be a third round of sampling if information from the first two rounds is contradictory or inconclusive?

   RESPONSE: Well drilling causes only very localized turbidity in the groundwater; any disturbance would be right at the installation point. Drilling wells through the landfill could potentially make conduits for contamination, so no wells will be drilled through the site.

   Based on existing information on the site's hydrogeology and predominant types of contamination, the contaminated groundwater from the site is probably flowing into the Scioto River near the landfill. The proposed monitoring well system is designed to detect contamination going that way. There is a potential for contaminants that are heavier than water, such as chlorinated organic compounds, to sink within the groundwater flow system beneath the site. To ensure that this type of situation is adequately investigated, the Work Plan and Quality Assurance Project Plan will be modified to change the location and depth of the deep wells. Monitoring well P4B will become P5B at the southern tip of the landfill. All of the deep monitoring wells (P5B, P6B, and P8B) will be drilled to the underlying shale formation instead of to the 100 foot depth limit. The well screens will be placed just above the shale unless contaminated zones are detected above the shale as noted in the Work Plan and QAPP.

   If sampling results are inconclusive or contradictory or are insufficient to allow the agencies to develop a plan for remedial action at the site, additional sampling will be required.

6. The Quality Assurance and Sampling Plan (pg 2, paragraph 2) incorrectly says the City maintains an infiltration gallery approximately one mile downstream from the site on the west bank of the river. That gallery was abandoned.

   RESPONSE: The infiltration gallery was abandoned since the site Workplan was written. The plan will be changed to reflect this comment.

7. The QAPP says organic gases came off ponded water along the western edge of the waste berm. When was this done and what were the results?

   RESPONSE: During a site visit by U.S. EPA, OEPA, CH2M Hill, and Warzyn on February 23, 1984, an HNU photoionizer detected low levels (2.2 parts per million) of volatile organic gases immediately above a leachate seep on the west side of the north-south landfill berm. No other readings above background were reported during the site visit.

8. Will U.S. EPA split samples with Pickaway county, and if so, who will do analyses?

   RESPONSE: Addressed in attachment on split sampling.

9. Has U.S. EPA abandoned theory of one upgradient and three down gradient monitoring wells?

   RESPONSE: The three downgradient, one upgradient well is a requirement for monitoring sites under the Resource Conservation and Recovery Act. The quanity and location of wells installed during remedial investigations of CERCLA sites is based on the scope of investigation needed to identify a remedy for the site.

10. What will the monitoring wells be cased with?

   RESPONSE: All monitoring wells, except W-12 and W-13, will be constructed of threaded PVC well casings and stainless steel well screens. Monitoring wells W-12 and W-13 will be constructed with stainless steel.

11. The City wants a list of detection limits for samples.

   RESPONSE: The list is attached.

PICKAWAY COUNTY BOARD OF COUNTY COMMISSIONERS
DONALD STROUS, RALPH ANKROM

1. The county wants to submit names for citizen representation on the research project team.

   RESPONSE: Addressed in attachment on community involvement

2. Split sampling should be conducted during the testing.

   RESPONSE: Addressed in attachment on split sampling.

ORAL COMMENTS RECEIVED AT PUBLIC MEETING, MARCH 14, 1985

Most comments received at the public meeting were repeated in the written comments, and so are addressed in the preceding pages. The following comments were presented at the meeting, but not in writing:

1. *Page 42, Cynthia Gillen. Ohio EPA should send ACTION results from previous sampling.

   RESPONSE: Ohio EPA sent Ms. Gillen copies of sampling results from Circleville and Earnhart Hill Water District.

2. Page 79 Linda King. Will dioxin be tested for?

   RESPONSE: Dioxin will be sampled for in the first round of soil, sediment and groundwater testing.

3. Page 86, David Cannon. It is appropriate to extend the comment period by 30 days.

   RESPONSE: U.S. EPA and Ohio EPA extended the public comment period by 30 days.

4. Page 87-88, Linda King. Air monitoring should be addressed in the agreement.

   RESPONSE: Monitoring of air quality will be performed while investigators are onsite. This is primarily for the safety of onsite workers because of their close proximity to site contaminants, especially during well drilling and other activities that disturb existing conditions. However, the air quality monitoring will also be applicable to evaluating conditions that could affect the safety of nearby residents.

   The air quality monitoring consists of measuring volatile organic gases and explosive mixtures of gas. All soil borings will be monitored for volatile organic gases, as specified in the Work Plan, page 11.

5. Page 89 Gary Betts. Although some people distrust government and industry, he believes people will support an effort to get sites such as Bowers cleaned up.

   RESPONSE: U.S. EPA and Ohio EPA's goal is to get the site investigated and cleaned up if necessary, and we appreciate everyone's support.

6. Page 90 Ralph Dunkle. There is evidence that material is still being disposed of at the site.

   RESPONSE: U.S. EPA and Ohio EPA have no evidence that dumping is still occurring at the site, but any information to the contrary should be reported immediately to one of the agencies.

* page numbers refer to the pages of the official transcript

7. Page 92-93 Mary Anne Edsall. Citizens will be exposed to contaminants during drilling.

RESPONSE: Contaminants during drilling are very unlikely to reach any citizen not actually on the site near the drilling. See also response to written comment on page three.

8. Page 95 Marsha Schneider. The order should include provisions to protect the rights and property of adjacent land owners.

RESPONSE: Under the consent agreement, the respondents are responsible for contacting the landowners and making arrangements with them for access to their property. By signing the consent agreement, the respondents have no more rights than they had previously concerning access to any land, including the Bowers Landfill itself.

9. Page 96-98 Dr. William Myers. 1) The County Health Department offers its assistance to U.S. EPA and Ohio EPA in conducting the investigation; 2) a full investigation is necessary; 3) the agencies didn't provide enough information to the public up to this point.

RESPONSE: 1) U.S. EPA and Ohio EPA appreciate the offer of assistance, and hope to work cooperatively with the health department throughout the Superfund project; 2) the agencies agree that a full investigation is vital to determining the type and extent of contamination at the site; 3) during negotiations with responsible parties, the agencies are unable to provide information that may have to be used for litigation if the negotiations should fail to result in a consent agreement.

10. Page 98 Cynthia Gillen. Judy Beck of U.S. EPA's Region V community relations staff said the region had successfully dealt with sites in floodplains. Ms. Gillen requests a list of the sites and how they were handled.

RESPONSE: Ms. Beck was responding by telephone in February 1985 to members of ACTION who were very concerned that the Bowers site was flooding. Ms. Beck indicated that unfortunately many landfills were put into wetlands and floodplains, so that the region has several cases of flooding Superfund sites. In saying that we had successfully dealt with the sites, Ms. Beck meant on an emergency basis, such as erecting berms or dikes, draining a site, or diverting water, in cases where contaminants threatened a water supply. Examples are Seymour and Enviro-Chem in Indiana, and A&F Materials in Illinois.

11. Page 99-100 Mark Scarpitti. 1) The gravel pitting should be taken into consideration when cleanup options are considered; 2) a clay cap might be "putting a lid on a bucket with a hole in it."

RESPONSE: 1) The need to take action on the gravel pitting will be based on results of the remedial investigation; 2) a clay cap may be considered as a remedial alternative during the feasibility study. Usually the purpose of a clay clap is to prevent rainwater, etc. from pushing contaminants further downward into groundwater, not to prevent the spread of contaminants already in the groundwater or soil. That problem would be addressed with another option.

12. Page 116-117 David Cannon. If U.S. EPA shares split samples with the community, provisions should be made for adequate quality control so the results will be useful.

    RESPONSE: Addressed in attachment on split sampling.

13. Page 117 Mary Anne Edsall. The public comment period should be extended.

    RESPONSE: The public comment period was extended by 30 days.

14. Page 121 Linda King. Will incineration be considered as a cleanup option if local laws prohibit incineration?

    RESPONSE: All viable alternatives must be considered in evaluating the best method for cleaning up a hazardous waste site. Even if incineration is considered, it doesn't mean it will be chosen for this site. We can't speculate on future local laws that may come into effect, but every effort will be made to accommodate local concerns, and to clean up the site in a safe and environmentally responsible manner.

APPENDIX A: RESPONSE TO COMMENTS ON COMMUNITY INVOLVEMENT

Many of the comments received on the Bowers consent order concern citizen involvement in the investigation. The county commissioners requested that U.S. EPA and Ohio EPA include citizen representation on the "research project team." The citizens' group, ACTION, had several comments. They requested: prior notification of changes in any plan and in sampling points, quarterly public meetings, representation on the project team (they prefer a rotating membership), and all raw data. Other commenters suggested the public be involved in the project to the extent possible.

Both U.S. EPA and Ohio EPA believe that community involvement is a critical element in the success of a Superfund project. The agencies discussed the comments at great length, and have developed the following plan for fulfilling the residents' desire to be informed and involved in the project, and the agencies' obligation to keep the project scientific, on schedule and consistent with agency policies:

Information committee. U.S. EPA and Ohio EPA will develop a committee representing the county, city , citizens' groups ACTION and L-ECHOS to meet regularly with project staff and to provide documents for discussion and review. The meetings would occur at least every other month in Circleville, and would be open to anyone else who wished to observe.

Purpose: To disseminate reports, data, and progress reports related to the remedial investigation and feasibility study of the Bowers Landfill. To provide liaison function with the rest of the community. To provide input to U.S. EPA and Ohio EPA, although the committee will not be a decision-making body and will not have authority to override any agency decision.

Structure: One member should represent the Pickaway County Board of Commissioners, the city of Circleville, the Pickaway County Board of Health, ACTION, and L-ECHOS, Ohio EPA, U.S. EPA, the Respondents and perhaps one at-large position. Each organization would choose its member, but for the purposes of consistency and effectiveness, the agencies ask that the same member (and a designated alternate, if desired) serve throughout the life of the project.

Format: Throughout an RI/FS a number of documents and reports are generated that generally are not reviewed by the community. However, U.S. EPA and Ohio EPA are able to disseminate the documents under certain conditions. We anticipate that we would provide them to and discuss them with the committee. The following are documents that the Respondents will be required to provide to the government, and that EPA would then provide to the committee:

Work plan
QA/QC plan
site safety plan
geophysical survey
biological survey

-more-

We will make available second drafts (ie. after U.S. and Ohio EPA have reviewed) of the following:

RI report
Exposure Assessment (EPA will actually do this report)
Feasibility Study (this is always made available for public comment)

Raw data. We cannot provide raw data that has not been through quality assurance/quality control procedures. Attached is an October 4, 1984 memo from William Ruckelshaus, then administrator of the agency, which describes the Agency's policy regarding the release of unreviewed material. This policy is still in effect. Once the data from the site has been through the required quality assurance/quality control procedures, the agency can provide all data and not just summaries.

Representation on the project team. Several of the comments asked that citizens be put on the "project team." The information committee is in lieu of that request because U.S. EPA and Ohio EPA cannot put a citizen on the project team for the following reasons:

Members of the "project team" as defined by the consent order are authorized to 1) take samples or direct sampling, 2) stop work, 3) make minor changes in field work, 4) observe, record or photograph the work, and 5) review records, files and documents.

We are not able to give citizens the authority for numbers 1,2,3. Number 4 could be allowed only at a distance, as we are not able to allow citizens on the site for safety and liability reasons. Number 5 will be accommodated by the information committee.

5. Quarterly public meetings. ACTION requested that the agencies hold quarterly public meetings to inform the community of the progress at the site. If there appears to be need for the meetings, they will be held. However, it may be that the more regular meetings with the information committee will fulfill that function. In addition, U.S. EPA will provide regular written updates to the community.

APPENDIX B: RESPONSE TO COMMENTS ON SPLIT SAMPLING

In addition to the comments received during the comment period on the consent order, U.S. EPA received a petition from Circleville residents and a letter from William A. Myers, M.D., Pickaway County Health Commissioner, requesting that split samples be provided to the residents.

As allowed under the consent order, U.S. EPA will provide a representative of the Pickaway County Board of Health, a set of split samples. Dr. Myers offered his assistance in facilitating the provision of split samples from U.S. EPA.

U.S. EPA and Ohio EPA request that the analysis of these split samples strictly adhere to all the requirements of the Quality Assurance Project Plan for this site, which has been approved by EPA's Quality Assurance Office. The Respondents' samples and U.S. EPA and Ohio EPA's samples must also adhere to the requirements of the QAPP. The QAPP contains highly sophisticated, state of the art technical requirements which must be observed so that contamination at and from the site can be successfully classified. EPA will acknowledge only those samples that have followed the QAPP for this site.

ACTION further requested that industry assume financial responsibility for the citizen's splits. Respondents are only required to undertake the measures that EPA would undertake if EPA was conducting the RI/FS with federal money. EPA does not fund citizens' split samples because the scientific quality of the project is ensured by a QAPP, and citizen samples are redundant. EPA will not require the Respondents to finance the citizens' samples.

APPENDIX C: LIST OF COMMENTERS

Oral comments were received at the March 14, 1985 public meeting from:

1. David Cannon, PPG Industries, Inc.
2. Cynthia Gillen, ACTION
3. Linda J. King
4. Garry Betts, ACTION & self
5. Ralph E. Dunkel, ACTION & self
6. Mary Anne Edsall
7. Mark Scarpitti, Soil Conservation Service
8. Marsha Schneider
9. William A. Myers, M.D., Pickaway County Health Commissioner

Written comments were received from:

1. Linda King (December 22, 1984 letter regarding split samples)
2. William A. Myers, M.D. (January 9, 1985 letter regarding split samples)
3. Linda King, Mary Anne Edsall, and Cynthia Gillen, ACTION
4. Pastor Alfred Krebs, Trinity Lutheran Church
5. Muriel Wright
6. John. A. Jordan, City of Circleville, Department of Public Utilities
7. Donald E. Strous and Ralph W. Ankrom, Pickaway County Board of Commissioners

Appendix D: Written comments and transcript of March 14 public meeting

(NOTE: The transcript includes only those portions with public comments; a complete copy of the transcript is available from EPA.)

OhioEPA

State of Ohio Environmental Protection Agency

P.O. Box 1049, 1800 WaterMark Dr.
Columbus, Ohio 43266-0149

Richard F. Celeste
Governor

Re: Bowers Landfill Site
Circleville, Ohio
Record of Decision

Mr. Valdas V. Adamkus
Regional Administrator
U.S. EPA, Region V
230 South Dearborn Street
Chicago, Illinois 60604

March 31, 1989

Dear Mr. Adamkus:

The Ohio Environmental Protection Agency (Ohio EPA) has reviewed the draft Record of Decision (ROD) for the Bowers Landfill site in Circleville, Ohio. This draft ROD was prepared pursuant to the terms of the Administrative Consent Order signed in 1985 by U.S. EPA, Ohio EPA, E.I. DuPont de Nemours and Co. and PPG Industries, Inc.

Changes to the draft ROD which addressed Ohio EPA's concerns were discussed with your Remedial Project Manager, Erin Moran, on March 29, 1989. On March 30, 1989, we received from your contractor a revised draft ROD which incorporated those changes. With these changes, the Ohio EPA concurs with this unsigned, undated draft ROD, a copy of which is enclosed herewith and incorporated herein by reference for identification purposes.

Please feel free to contact me at (614) 644-2927 if you have any questions or comments regarding this matter.

Sincerely,

Richard L Shank

Richard L. Shank, Ph.D.
Director

cc: Maury Walsh, Deputy Director
cc: Kathy Davidson, OCA
cc: Deborah Strayton, CDO
cc: Jack Van Kley, OAG
cc: Paul Hancock, OAG
cc: Mary Gade, Office of Superfund
cc: Erin Moran, Office of Superfund
cc: Malcolm Petroccia, PPG
cc: Bernard Saydlowski, DuPont

Tuesday, Dec 1, 1992

Reynolds Metals near treating potliner from own primary smelters

By EDWARD WORDEN

NEW YORK — Reynolds Metals Co. is poised to treat its own spent potliner from primary aluminum smelters while still weighing the viability of recycling the material.

Moreover, negotiations are being held with "one large generator" of potliner to lease or purchase part of Reynolds' treatment capacity, while other smelters are looking at the situation and want to submit potliner samples for testing, according to a Reynolds official.

E. Jack Gates, general manager of the reduction and reclamation division, said the company's $50-million project at Gum Springs, Ark., is intended to be up and running by April 1, 1993.

Gates noted that time is of the essence for smelters that currently take potliner to landfill sites. The federal Environmental Protection Agency intends to implement a landfill ban for untreated potliner in early 1994 and will require that the potliner be treated with the best available technology at the time, Gates said. Pre-treatment will be required prior to disposal.

The new Reynolds plant will include two gas-fired kilns, each with capacity to treat 60,000 metric tons of potliner a year. Small amounts of cyanide will be destroyed by the heat, and fluorides will be made insoluble, Gates said.

But of the 120,000 tons in capacity, only 30,000 tons will be required to treat Reynolds' own potliner from the company's 848,000-tons-a-year primary capacity in the United States and Canada. Consequently, Reynolds will be able to get into the custom-treatment business for other companies' potliner, Gates said.

Bechtel Group Inc. called it a "state-of-the-art facility for handling waste created during aluminum production." Bechtel's mining and metals unit is designing and retrofitting the facility for Reynolds.

The recyclability of material from the new Reynolds plant is yet to be determined. Gates said he has seen dense bricks produced from the ash-type residue, and that one avenue being investigated is the use of the material in refractory-type applications.

The company previously said it would consider going into similar ventures overseas, but that Reynolds for now is getting in at the ground floor, since other facilities would presumably be a long time from obtaining necessary permits (AMM, March 10).

Spent potliner is a carbon-based material that comes from electrolytic reduction of alumina into aluminum. The EPA has cited at least four smelter sites as so-called "Superfund" candidates and included others in its list of potentially hazardous sites.

No. 380 SECONDARY ALUMINUM INGOT PRICES

Monthly and annual average prices of remelt aluminum ingot (No. 380 3% Zn.) in Midwest, cents per pound; compiled from quotations published in American Metal Market.

1982	48.27
1983	66.23
1984	70.68
1985	57.03*
1986	59.83
1987	71.38

	1988	1989	1990
Jan.	87.10	101.43	72.20
Feb.	90.05	102.29	69.86
Mar.	95.98	100.33	74.13
April	102.52	97.75	82.25
May	100.36	97.48	80.82
June	103.09	94.09	77.45
July	103.20	88.20	76.40
Aug.	101.07	81.86	79.58
Sept.	100.48	83.43	79.38
Oct.	97.11	81.95	77.66
Nov.	96.50	78.33	73.53
Dec.	99.95	73.50	71.61
Average	98.12	89.89	76.24

* Nominal.

AMERICAN METAL MARKET, MARCH 10, 1992

Spent potliner project on track

Reynolds sees treatment facility ready within year

By BOB REGAN

NEW YORK — Reynolds Metals Co. expects to have its first spent potliner treatment facility up and running—and ready for outside business—within a year.

A spokesman for the Richmond, Va.,-based aluminum producer also said Reynolds has the inside track on what could be "a very viable commercial operation" and that the company is mulling similar ventures overseas.

Reynolds got a green light to proceed with the $50-million venture in the final weeks of 1991 after the Environmental Protection Agency ruled the ash from Reynolds' thermal process was non-hazardous and eligible for disposal in landfills (AMM, Dec. 30).

A plant now under construction in Gum Springs, Ark., has enough spare capacity to process spent potliner generated by better than two-thirds of the non-Reynolds primary aluminum capacity in the United States.

According to John R. Amos, manager for energy resources, the company would need only a quarter of the Gum Springs plant's 120,000 metric tons a year in processing capacity to handle spent potliner from its 848,000-ton-a-year primary capacity in the United States and Canada.

This leaves enough room to handle spent potliner generated by smelters aggregating 2.5 million tons of annual capacity—perhaps after first digging into the waste material piled up at many smelter sites while new disposal regulations were being thrashed out.

Spent potliner, a carbon-based material generated in the electrolytic reduction of alumina into aluminum, had been posing an increasingly nettlesome disposal problem for U.S. smelters for years. The EPA cited at least four smelter sites as candidates for its National Priorities List, the so-called Superfund sites, and several others were included in EPA's list of potentially hazardous waste sites.

(See REYNOLDS, page 16)

Reynolds' potliner project on track

(Continued from page 2)

Asked if transportation of spent potliner over great distances would be a limiting factor economically, Amos said it might in some cases, but this will become less of a factor after the effective date of land ban regulations, which will require pre-treatment prior to disposal.

Amos said Reynolds was getting in at the ground floor. "There might be others who will attempt to come up with a better mousetrap, but they are probably years away from obtaining the necessary permits to operate such a facility," he said (AMM, Jan. 28).

Asked if the company's plans for its process include similar facilities elsewhere in North America or abroad, Amos said, "We are considering that possibility, but at the moment it is only in a discussion stage."

Harry V. Helton, Reynolds executive vice president for metals and raw materials, said the next step is developing commercial applications for the residue at the Gum Springs plant, "thus completing the recycling loop."

Helton and Amos said the company has been looking at a number of commercial possibilities over and above the cinder block and roof tile products mentioned early on, including selling the material to companies interested in the ash residue's heat value and chemical properties.

Helton said the $50-million price tag on the Gum Springs venture represented relocation of the processing equipment from a pilot facility nearby, site preparation, refurbishing and construction costs.

Potliner decision opens doors

Reynolds go-ahead may also help others

By MYRA PINKHAM

NEW YORK — The recent decision by the Environmental Protection Agency to delist the final residue of spent potliner processed by Reynolds Metals Co.'s thermal treatment technology might be good news for more than just the Richmond, Va., aluminum producer. It might open the door for a number of other processes that have been under research and development by the industry for more than 10 years.

In fact, Columbia Aluminum Corp., Goldendale, Wash., is attempting to climb onto the delisting bandwagon. In February, it plans to do initial test burns on potliner using a mineral rockwool cupola.

Roy Carwile, director of environmental affairs for the Aluminum Association, Washington, said the industry was thrown a curve in September 1988 when the EPA listed spent potliner as a hazardous waste.

It wasn't as if the industry was unaware of the potential problems with this high-volume waste.

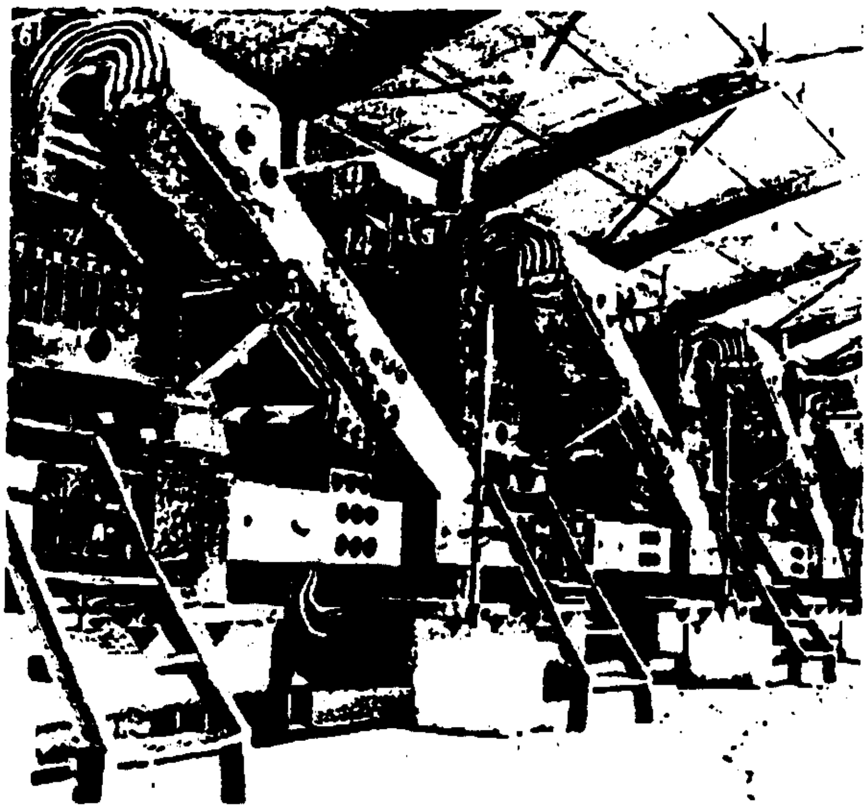
They knew potliner contains certain environmentally undesirable components, primarily cyanide but also fluoride and certain organics, which would be dangerous if they leach out into groundwater.

"The industry has been attempting to find productive ways of getting rid of this stuff," Carwile explained.

Prior to the listing, the industry was in the midst of several research projects for the treatment of spent potliner, five of which seemed quite promising.

According to Dennis Sager, Columbia Aluminum technical manager, the company plans to burn about 30 tons of spent potliner in an attempt to see if it is delistable in an on-site mineral rockwool cupola. Columbia is not the first to attempt this application. Prior to the listing, 8,000 tons of spent potliner had been processed this way.

The spent potliner generally replaces about 30 percent of the coke used in the process, although it can replace up to 75 percent, lowering potential volatile organic carbon emissions, according to written comments from the Aluminum Association to the EPA. Also, the fluoride in



ALUMINUM PRODUCERS in the United States generate anywhere from 100,000 to 150,000 tons of spent potliner each year.

the potliner lowers the melting temperature of the glass melt. This process destroys the cyanide, and the fluoride goes into the product or to the gas collection

The Reynolds rotary kiln process, which recently won a delisting battle with the EPA, involves feeding the spent potliner through big kilns operating at high temperature, according to John Amos, Reynolds manager of energy resources. Sand and limestone is added to the feed in order to chemically bind with the fluoride.

"This process burns off the cyanide and makes the fluoride inactive," Amos said, so the residue can be disposed of at a regular landfill instead of a hazardous waste landfill. The residue, however, reportedly is three times the volume of the spent potliner itself.

Reynolds already has processed 300,000 tons of spent potliner with this process at its previously shuttered alumina plant in Bauxite, Ark. It currently is constructing a $40-million to $50-million facility on the site of a former smelter in Arkadelphia, Ark., slated to go on-stream toward the end of this year (AMM, Dec. 30). It will have a 120,000- to 130,000-ton-per-year capacity.

Another potential use for spent potliner, according to comments that the Aluminum Association filed with the EPA, is in cement kilns. Because of the amount of British thermal units for the carbon portion of the spent potliner (up to 8,000 Btus per pound), cement makers can use the material to replace up to 5 percent of their coal needs, the comments said. Also, the fluoride in the potliner reduces the temperature of the clinkering reaction. The heat destroys the cyanide and the fluoride either goes into the product or is reclaimed by the dust recycle system, the Aluminum Association said.

More than 30,000 tons of spent potliner were burned at Santee Cement Co. in Holly Hill, S.C., over a three-year period, and there were a number of other tests under way at other cement kilns in the United States and Canada. But all that ended when spent potliner was listed as a hazardous waste.

Another potential use is as a fuel substitute in steelmaking. It can replace some carbon and fluorspar in basic oxygen furnaces and some of the coke and fluorspar in iron-making cupolas. These processes, the comments said, destroy the cyanide and capture the fluoride. About 2,000 tons of the material had been tested on a commercial-scale operation prior to the listing.

Spent potliner also received a positive report in a feasibility study, the comments said, when used in coal-fired power plants, but further testing ceased when the material was listed as a hazardous waste.

According to Robert Kayser, chief of the delisting section of the EPA's office of solid waste, the agency would consider other petitions for delisting the end product of spent potliner but thus far none has been received.

Alcoa welding emissions study may aid producers

WASHINGTON — A welding emissions study conducted at the laboratories of Aluminum Co. of America, Pittsburgh, can help aluminum producers in meeting Occupational Safety and Health regulations, according to Seymour G. Epstein, technical director of the Aluminum Association, Washington.

Seven combinations of base alloys and fillers were tested under "worse case" conditions. Levels of ozone, nitrogen oxides, lithium, beryllium and antimony were measured. In some of the tests, elevated levels of emissions were found that could exceed limits established by OSHA, according to Epstein.

"The association encourages member companies to use this information in preparing material safety data sheets and conducting employee training," Epstein said.

The report is the third study of welding emissions sponsored by the association as part of its health research program.

Reynolds is given EPA's green light

Gets go-ahead to process potliner

By BOB REGAN

NEW YORK — Reynolds Metals Co. last week got the green light from the Environmental *Protection Agency* to proceed with a $40-million to $50-million commercial-scale business to convert aluminum smelter potliner into environmentally acceptable landfill material.

Further down the road, according to John R. Amos, Reynolds' manager for energy resources, someone might be able to complete the recycling loop by making a viable business of converting the ash residue into cinder block, roof tiles and similar products.

In a telephone interview, Amos said Reynolds has already been approached by two parties "seriously interested in the possibilities."

The Richmond, Va.-based producer and marketer of aluminum ingot, mill products and packaging products plans to have a spent potliner processing operation up and running in Arkadelphia, Ark., in about a year.

Arkadelphia is the site of a former Reynolds primary aluminum smelter that was taken down and broken up in the mid-1980s, when aluminum prices were weak and high-cost facilities were being shuttered, sold or dismantled.

Amos said the Arkadelphia facility will have capacity to process 120,000 to 130,000 metric tons of spent potliner a year. Reynolds' own smelters in the United States and Canada generate about 30,000 tons of the material each year.

Amos said Reynolds has been on the cutting edge of

The Arkadelphia facility will have capacity to process 120,000 to 130,000 metric tons of spent potliner a year.

work to develop an acceptable solution to the potliner disposal problem and the company expects to use its lead to make a going business of processing discarded potliner for some of its North American competitors.

Last summer, Reynolds was preparing test burns of potliner from Aluminum Co. of America's big U.S. smelter system. Amos said Friday the tests never came off, however.

Amos noted Alcoa, among others, has been doing considerable work on potliner processing methods and a few patents have been issued, but Reynolds expects to be alone in the field when the Arkadelphia plant opens its doors a year from now.

Asked if Reynolds planned to take in any partners, Amos said the idea has been discussed and, while the door hasn't been entirely shut, the present inclination is for Reynolds to move forward on its own.

Amos said Reynolds has already treated 400,000 tons of spent potliner at its pilot plant in Bauxite, Ark., which has been using stored waste material generated in the United States and at the company's big Baie Comeau, Quebec, smelter.

The Reynolds process blends the potliner with limestone and a sandy material prior to roasting at elevated temperatures in a rotary kiln. Cyanides in the potliner are destroyed in the roasting and soluble fluoride is converted to calcium fluoride, which Reynolds terms "stable, harmless and insoluble."

CHANGING PRICES

Painted aluminum prices hiked

NEW YORK — Norandal USA Inc. said Friday it was increasing prices for painted aluminum products by 5 cents a pound.

The Brentwood, Tenn.-based aluminum sheet and foil producer said it would apply the increase to orders booked on and after Dec. 30 and to all shipments beginning March 1.

Norandal said the increase in the paint extras, the first since it began publishing them in February 1988, was needed to cover higher paint, fabrication and modernization costs.

Norandal's move follows 5-cent hikes posted by Commonwealth Aluminum Corp., Alumax Inc. and Consolidated Aluminum Corp. earlier this month.

'eynolds touts potliner recycling system

BOB REGAN

NEW YORK — Reynolds ...als Co., which has the ... e to itself with the world's ...st viable aluminum spent ...tliner processing operation ...nd running, plans to take ...n the road once the $60-...illion Gum Springs, Ark., ...ant has established itself on ...rm commercial basis.

...he next stop in expansion ...ans probably will be Que...c, where there is a heavy ...centration of primary alu...ium smelter capacity—in...uding nearly half a million ...etric tons a year belonging ... Reynolds. But there's no ...h, noted E. Jack Gates, vice ...resident and general manag...r, raw materials, for the ...hmond, Va.,-based alu...ium and packaging giant.

During a mid-March tour of ...e Gum Springs facility, Gates, ...nt manager Paul D. Webb ...l other Reynolds officials ...id that there were a number ...f imponderables to consider ... such an expansion and the ...w venture had quite a few ...ings on its plate already.

The imponderables appar...ly range from the shifting ...ds of environmental regu...ation to whether or not Alcan ...luminium Ltd., which alone ...counts for just about half of ...nada's nearly 2.3 million tons of primary capacity, would be a customer for a ...nadian venture.

Asked if there were potential customers in Russia's huge but environmentally neglected aluminum smelter base, the Reynolds officials said, "Oh, the potential's there, but not the money—and they've got bigger problems right now than what to do with spent potliner."

Gates added, however, that while Siberian possibilities "are quite a way down the road," the company has been discussing possibilities with aluminum producers in Western Europe and South America. "We are spreading," said Webb, adding, "Right now we are the only ones out there. Our process is the only one in the world and our residue is the only one delisted" by the U.S. Environmental Protection Agency.

There have been other processes proposed and tried and Alcan, which Reynolds would like to have as a customer, is now saying its researchers "believe they have found an economical and 'green' solution" to the aluminum industry's spent potliner problem since the EPA in 1988 defined it as a hazardous waste ineligible for disposal in landfills.

Alcan said it is preparing a presentation to EPA on what it calls a low-caustic leaching and liming (LCLL) process. Alcan said it also will be seeking aluminum industry acceptance through presentations to the Quebec aluminum industry association, which is scheduled to have a report ready in April.

Alcan said its process is a "cost-effective" hydrometallurgical process in which the potliner is crushed, the cyanides destroyed, soluble chemicals recovered and remaining solids converted to a non-toxic, low-grade fuel. Alcan also noted that its process doesn't require bulky additives that facilitate the cyanide-destroying thermal process while tripling the amount of material to be landfilled.

The Reynolds officials noted that many proposed solutions entail chemical operations at one stage or another and "when you get into that, you're opening another can of (regulatory) worms." The Reynolds officials discounted the additive requirement because the idea behind the Gum Springs project is to convert all the material to usable materials.

This is the task accepted by JTM Industries Inc., a Union Pacific unit which operates a plant of its own on the Gum Springs property to separate the treated potliner by size, modify it if necessary and market it as roadbed or parking lot fill or other useful products.

Asked if JTM would follow Reynolds to Quebec, Dennis L. Kinder, executive vice president, said, "We would want to go, too. Union Pacific operates up there, and there is a market for our product there as well."

Another candidate for the commercial spent potliner treatment field is a process developed by the Chicago-based Institute of Gas Technology (IGT), an engineering and consulting firm specializing in energy and environmental matters.

According to Hamid A. Abbasi, assistant director of applied combustion research, while Reynolds is first on line with a commercial process, there still is time for others to get in—particularly inasmu... as EPA has put off until 1996 ... "land ban" ruling that originally was to have blocked landfilling of untreated potliner in 1994.

Abbasi said IGT's process, which is being readied for pilot-plant status in a program involving Columbia Aluminum Corp. of Goldendale, Wash., still needs a big corporate backer. IGT's process, called "Cycom," needs no bulky additives and "our goal is nothing for the landfills," Abbasi said, adding that Cycom's output conceivably could end up being furnace

(See REYNOLDS, page 16)

Petro heads Inco Alloys; former Crucible executive

By KEN... J. SELLAND

PITTSBURGH — Frank J. Petro, the former head of Crucible Materials Corp.'s Specialty Metals division who left that position last year following a reported management clash, has been named president of Inco Alloys International Inc., the United States' largest superalloy producer.

Petro was named to Inco Alloys' helm effective yesterday, according to a statement released by Inco Alloys' parent, Toronto-based Inco Ltd., ... of the ... producers.

Petro, ..., served as president of Specialty Metals ... 19.. to 19.. ... steel industry ... between Petro and John Vasel, chairman and president of Crucible Materials, Syracuse, N.Y. ...

(See PETRO, page 9)

Impala Platinum faces

By TERRY BELL
Special to American Metal Market

JOHANNESBURG, South Africa — A pending legal battle over Gencor Ltd.'s Impala Platinum (Implats) lease and royalty agreements raises some questions about the Implats share price in coming months but the looming fight should not impact platinum production.

The problems of having done deals with a now-discredited political structure are coming home to roost—but with Implats management, not the mines themselves.

Gencor and Implats enjoyed a comfortable and lucrative existence under the regime of the autocratic pres... ... Lucas Mangope in the ...

fered. After he was deposed by Mangope, he fled into exile in neighboring Botswana and his younger brother promptly accepted the chieftainship—and the Implats offer.

Now Edward Molotlegi is returning to claim his rightful place from his younger—and more pliable—brother.

And he is again taking on Implats, where chairman Mike McMahon has offered talks on "any problematic aspects" of the royalty agreement.

"We do not agree that if George Molotlegi's position as acting chief is invalidated,

IN TODAY'S ISSU...

The powers would include declaring a state of emergency, if necessary, and sending South African troops to the region to protect voters. That would severely undercut Zulu leader Mangosuthu Buthelezi, who has vowed to oppose the election on grounds it will lead to the extinction of Zulu sovereignty.

About 6.5 million people live in Natal, which includes the semi-independent KwaZulu homeland.

Political violence linked to

lands set up under apartheid. The transitional council this month took over two homelands whose leaders were opposed to elections.

Buthelezi yesterday rejected plans for a summit scheduled for today on quelling political violence in the region. His nephew, Zulu King Goodwill Zwelethini, also rejected the invitation to meet with President F.W. de Klerk and ANC president Nelson Mandela.

Buthelezi said the violence was the beginning of "a final

some percnee on rooftops or firing fro windows, shot into th of marchers. Thirty-f ple were killed (AM 29). In the worst incid Zulus were killed out ANC headquarters. A cials said their

Reynolds touts potliner system

(Continued from page 2)

bricks usable in the aluminum pots.

Reynolds noted that the product coming out of its Gum Springs plant has been EPA-delisted as a hazardous waste and the plant is "fully permitted and designed to meet future Clean Air Act requirements." The plant will be able to treat 120,000 tons of spent potliner a year—just about all the potliner generated by the aluminum industry in the U.S.—with the late-March start-up of the second of two kilns.

CHANGING PRICES

Brass mills shift copper values

NEW YORK — Three domestic brass mills revised product prices yesterday and Monday to reflect changing values for contained copper.

Ansonia Copper & Brass Inc., Ansonia, Conn., effective yesterday, altered prices to show copper down 0.5 cent to \$1.045 a pound.

Also effective yesterday, Miller Co., Meriden, Conn., modified prices to show a 1-cent hike in copper to \$1.04 a pound. The move followed a 1-cent decrease Friday to \$1.03 a pound.

Effective Monday, Outokumpu American Brass Co., Buffalo, N.Y., altered prices to show a 1-cent slip in copper to \$1.05 a pound.

LME stock

NEW YORK — Metal Exchange wa stocks of aluminum nickel, tin and dropped since Friday while aluminum, le special high-grade creased, the exchan Tuesday morning.

Aluminum alloy fell ric tons to 45,080 ton slid 54 tons to 136,284 dipped 30 tons to 23, and copper slipped 6. to 506,875 tons, of 498,100 tons were and 10,775 tons were

Aluminum jumped to 2,598,700 tons, lead 2,700 tons to 334,800

Comex wareh stocks move

NEW YORK — Co Exchange warehouse copper, gold and dropped since the business Thursday, said Tuesday morning

Copper fell 1,128 38,653 tons, gold slid ounces to 2,732,635 ou silver slipped 1,184,12 to 240,721,729 ounces.